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Cover

Nuytsia floribunda (Labill.) R. Br. ex Fenzl (Loranthaceae) — the Western Australian Christmas Tree is one of the few aborescent mistletoes in the world. This endemic tree is a semi-parasite common in sandy soil from the Murchison River to Israelite Bay. The journal is named after the plant, which in turn commemorates Pieter Nuyts, an ambassador of the Dutch East India Company, who in 1627 accompanied the “Gulde Zeepard” on one of the first explorations along the south coast of Australia.

Cover design by Sue Marais

Photograph A.S. George

***Calothamnus superbus* T.J. Hawkeswood & F.H. Mollemans
(Leptospermoideae: Myrtaceae), a new species from south-west
Western Australia**

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Abstract

Hawkeswood, T.J. & Mollemans, F.H. *Calothamnus superbus* T.J. Hawkeswood & F.H. Mollemans (Leptospermoideae: Myrtaceae), a new species from south-west Western Australia. Nuytsia 8(3): 311-318 (1992). A new 5-merous species of *Calothamnus*, *C. superbus* Hawkeswood & Mollemans, is described from sandplains in the Pigeon Rocks area, south-west Western Australia. Its affinities with the closely related species, *C. aridus* T.J. Hawkeswood, are outlined, and ecological data provided. The plant is not represented in any National Parks or Nature Reserves but its survival is probably ensured due to its isolated location.

Introduction

During 1990, an apparently undescribed 5-merous taxon of *Calothamnus* (Leptospermoideae: Myrtaceae), was located by the second author in a remote area near Pigeon Rocks, south-west Western Australia. Further research and collections have indicated that this taxon is indeed distinct and previously undescribed. The new species is described below. The terminology used in the description and general format follows that of Hawkeswood (1984a,b, 1987).

Taxonomy

***Calothamnus superbus* T.J. Hawkeswood & F.H. Mollemans, sp. nov. (Figures 1-4)**

Frutex erectus ad 2.5 m altus. Folia linearia, teretia, erecta, (10)13-15(18) cm longa, 1.2-1.6 mm lata, mucronata, glabra. Flores fasciculati vel breviter spicati. Calycis tubus plerumque 4-5 mm longis, glabris; calycis-lobi 1-1.5 mm longi. Petala 3-5 mm longa, ferruginea. Unguis staminalis 20-25 mm longus, 1.8-2.1 mm latus, glaber; filamentis marginalibus 12-17. Fructus globulus vel \pm cylindraceus, 5-7 mm longus, 7-9 mm latus, glaber. Semina plerumque 1-1.4 mm longa, ferruginea.

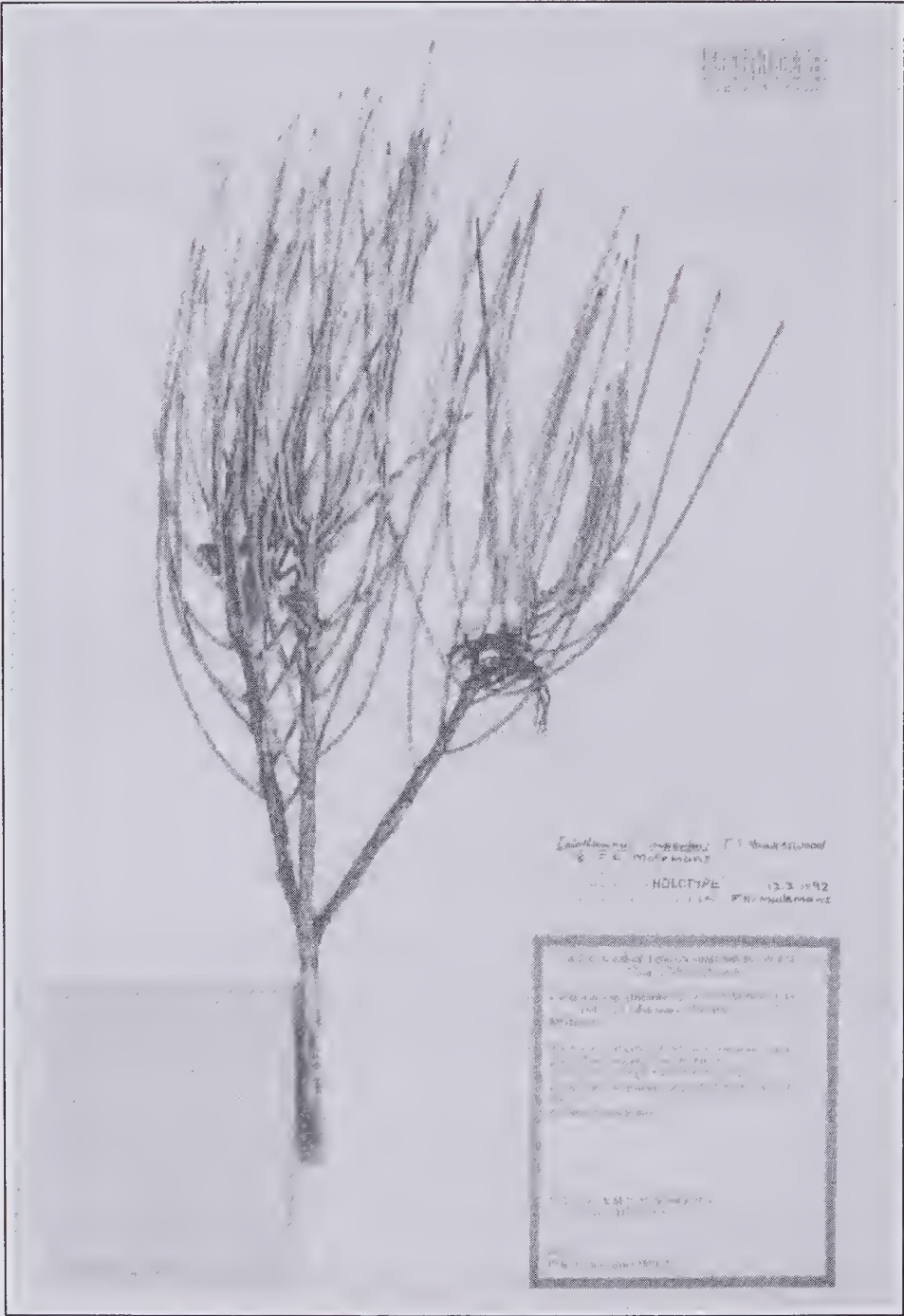


Figure 1. *Calothamnus superbus* T.J. Hawkeswood & F.H. Mollemans - Holotype (F.H. & M.P. Mollemans 3078).



Figure 2. Habit of *Calothamnus superbis* T.J. Hawkeswood & F.H. Mollemans in mixed shrubland and heath near Pigeon Rocks. (Photo: F.H. Mollemans).

Typus: Track from Emu Fence, east towards Pigeon Rocks Tank & west of Clampton Mineral Prospect (precise locality withheld), alt. c. 510 m; abundance uncommon; 11 July 1990, F.H. & M.P. Mollemans 3078 (holo: PERTH). (Figure 1)

Erect, wide, compact to spreading, multi-stemmed, diffuse branching, straggly to somewhat compact, glabrous *shrubs* to 2.5 metres high, with thick stems and hard grey bark, often splitting at or near the bases of the trunks. Young *branches* mostly glabrous. *Leaves* sessile, linear, terete, erect, rigid, (10)13-15(18) cm long, 1.2-1.6 mm wide, glabrous, rough, pungent, narrowed into a thin, sharp, straight apex 4-7 mm long, bright pale green to yellowish-green; oil glands very prominent and exerted into the epidermis, giving rise to the rough leaf surface. *Flowers* 2-5 (mostly 3) arranged in a cluster or 5-8(10) in a loose spike amongst leaves on younger branches. *Calyx-tube* narrow campanulate to almost cylindrical, 4-5 mm long, glabrous; oil glands prominent; rhachis usually dilated at the base of the calyx-tube; *calyx-lobes* deltoid, mostly acute, concave, 1-1.5 mm long, glabrous; margins thin, scarious, partially ciliate. *Petals* obovate, concave, obtuse, 3-5 mm long, thin, mostly glabrous, but with a few simple, scattered hairs, orange-brown; margins thin, glabrous. *Staminal claws* \pm equal, free, 20-25 mm long, 1.8-2.1 mm wide, glabrous, orange-red in lower half to two-thirds, pink-red in upper portion; marginal *filaments* 12-17; *anthers* linear, 1-1.4 mm long, brown. *Style* slender 15-25 mm long, glabrous, pink-red, stigma small, often persistent in young fruit. Summit of *ovary* densely pubescent. *Fruit* globular or depressed globular to almost cylindrical (rarely), 5-7 mm long, 7-9 mm wide, smooth or with irregular bulges, ribs and/or striations, mostly truncate or very shortly 5-lobed (calyx-lobes persistent in young fruit and usually absent in older, worn fruit). Fertile *seeds* linear-oblong, 1.0-1.4(1.5) mm long, angular, cuncate, often obliquely truncate, glabrous; testa dark reddish-brown. *Ovulodes* similar to fertile seeds, mostly 1.0-1.2 mm long, slightly paler in colour, usually obliquely truncate, glabrous.



Figure 3. Close-up of a branch of *Calothamnus superbus* T.J. Hawkeswood & F.H. Mollemans in mixed shrubland and heath near Pigeon Rocks showing a cluster of young fruiting capsules. (Photo: F.H. Mollemans).

Other specimens examined. WESTERN AUSTRALIA: Pigeon Rocks (Clamptons Vermin Fence track, east of vermin fence), 12 July 1991, *F.H. Mollemans* 3812 (PERTH); Pigeon Rocks (Clamptons Vermin Fence track, east of vermin fence), 13 July 1991, *F.H. Mollemans* 3813 (PERTH).

Distribution. Known only from two sites in the Pigeon Rocks area ($29^{\circ}52'S$, $118^{\circ}39'E$), south-west Western Australia (Figure 4). *C. superbus* occurs c. 100 km south of the most southerly known occurrence of *C. aridus*, and the northernmost distribution of *C. gilesii* is sympatric with that of *C. superbus*. The sympatric distribution of *C. superbus* and *C. gilesii* caused initial confusion during the return collection trip in July 1991 (because of morphological resemblance), however, it was determined during a 3 km transect on foot along Clamptons Vermin Fence track that *C. gilesii* and *C. superbus* are not sympatric at the local scale as they do not grow together.

Habitat. Grows in pale yellow brown sand with scattered ferruginous pebbles of laterite in mixed sandplain heath with *Acacia* (Mimosaceae), *Grevillea* (Proteaceae) and *Allocasuarina* (Casuarinaceae) or in pale yellow brown sand in mixed shrubland and heath with *Grevillea* (Proteaceae), *Melaleuca* (Myrtaceae) and *Boronia ternata* (Rutaceae).

Flowering and fruiting period. Flowering in July 1990 when the initial collection was made, but plants were in fruit in July 1991; this taxon is therefore thought to flower opportunistically depending on rainfall.

Conservation status. 2V using the criteria of Briggs & Leigh (1988). *Calothamnus superbus* is not represented in any National Park or Nature Reserves but its isolated location should afford a significant degree of protection from land clearing, residential development and illicit flower collection at least in the near future. However, at one of the sites where *C. superbus* was found (*Mollemans* 3812), there was evidence of a recent fire so that bushfires may prove to be a possible

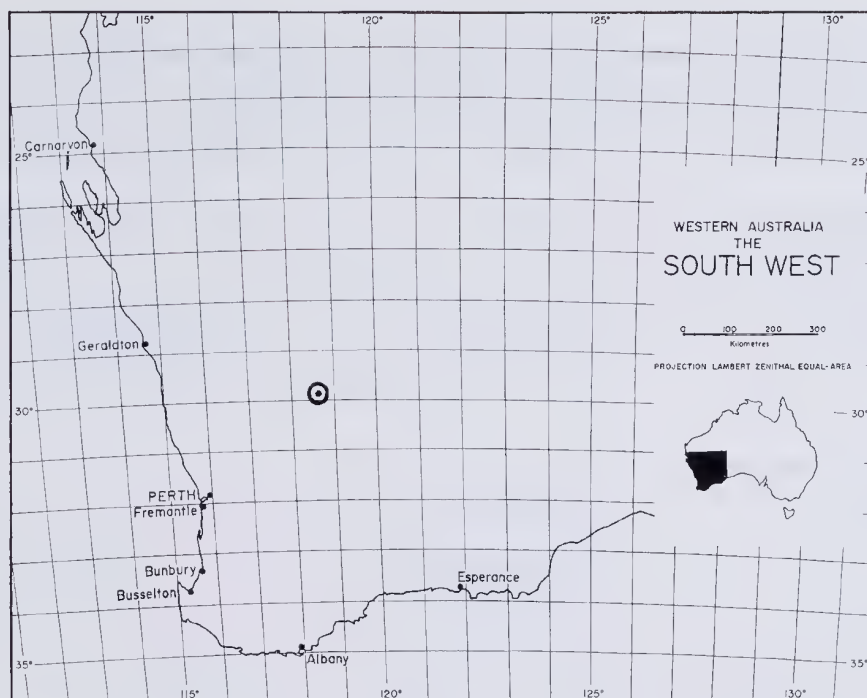


Figure 4. Distribution of *C. superbus* T.J. Hawkeswood & F.H. Mollemans.

and serious threat especially considering the small size of known *C. superbus* populations, viz. only about 25 plants were counted by Mollemans at the first site (Mollemans 3812) and about 18 at the other site (Mollemans 3813). The degree of susceptibility of *C. superbus* to fires is not known and perhaps fires and their effects should be closely monitored in the future.

Erymology. The specific epithet *superbus*, from Latin, meaning impressive or exalted, refers in part to the distinctive pale green to yellow-green, erect foliage of this species and to the plants prominence in the localized area within which it occurs.

Discussion

There are about twenty 5-merous species of *Calothamnus*, and *C. superbus* is most closely related to *C. aridus* T.J. Hawkeswood (Hawkeswood 1984a). A comparison of some taxonomic and ecological features of these two species is provided in Table 1.

Morphological differences. *C. superbus* and *C. aridus* can be clearly distinguished on the basis of the four leaf characters given in Table 1. Differences in the morphology and size of the calyx-tube, petal pubescence, width of the staminal claws and the number of filaments per staminal claw also distinguish *C. superbus* from *C. aridus*. Of these characters, leaf size (length and width), pubescence of calyx-tube and the number of marginal filaments per staminal claw are the most important. Fertile seed size differences are also highly significant (Table 1).

Table 1. Comparison of some important taxonomic and ecological features of *Calothamnus aridus* T.J. Hawkeswood and *C. superbus* T.J. Hawkeswood & F.H. Mollemans

Character	<i>C. aridus</i>	<i>C. superbus</i>
Leaf length (mm)	(5)7-10(12)	(10)13-15(18)
Leaf width (mm)	0.6-1.2	1.2-1.6
Leaf colour	Dark green to olive green	Bright pale green to yellow-green
Leaf apex length (mm)	2-3	4-7
Calyx-tube length (mm)	(2)2.5	4-5
Calyx-tube	Pubescent	Glabrous
Petals	Densely pubescent	Few scattered hairs
Petal margins	Ciliate	Glabrous
Staminal claw width (mm)	1.0-1.5	1.8-2.1
Number of marginal filaments per staminal claw	10-12	12-17
Fertile seed length (mm)	1.5-2.0	1.0-1.4(1.5)
Habitat	Red sand, <i>Triodia-Eucalyptus</i> woodland; <i>Triodia</i> sandplain	Yellow sand, mixed heath, sandplain

Fruit size has been important in delineating and differentiating other *Calothamnus* taxa (Hawkeswood 1984a,b, 1987), but this character is not so readily applicable in distinguishing *C. superbus* and *C. aridus*. The two known populations of *C. superbus* have variable fruit size with many fruits larger than those of *C. aridus*, but there is an overlap in size range of fruits of the two species, so this character, if used in isolation, is not reliable in differentiating the two taxa.

Non-flowering *C. superbus* plants resemble those of *C. gilesii* F. Muell but the fruit of the latter species are not depressed-globular in shape. In addition, the fruits of *C. gilesii* are much larger than those of *C. superbus*, and *C. gilesii* is not so tall or broad in habit, nor does it have the superb ascending leaves of *C. superbus*.

Ecological differences. *Calothamnus superbus* and *C. aridus* have the most inland distribution of any species in the genus. However, the habitats in which they occur are quite different (Table 1) and the soil type and other environmental factors may have been important in the evolution and genetic integrity of these two species.

Possible evolutionary relationships. *C. superbus*, like all species of *Calothamnus*, other than *C. aridus*, lacks pubescent petals. This is an important difference between *C. superbus* and *C. aridus*, and maintains *C. aridus* as the only species of *Calothamnus* which possesses petals covered in short, appressed, simple hairs (see Hawkeswood 1984a). Despite this difference, it is very clear, on the basis of other characters (see Table 1) that *C. superbus* is very closely related to *C. aridus*.

Hawkeswood (1984a), noted that *C. aridus* was not closely related to any other *Calothamnus* species. But the new species *C. superbus*, because of its lack of petal pubescence and its very close relationship to *C. aridus*, appears to provide a link between *C. aridus* and other *Calothamnus* species which has not previously been evident. However, absence of petal indumentum is only one common character among a number of characters in which *C. superbus* (in common with *C. aridus*) differs from other species of *Calothamnus*, so the apparent link between *C. aridus* and other species of *Calothamnus* provided by *C. superbus* is in fact only superficial.

C. aridus has an arid zone distribution. The presence of petal indumentum in this species and its absence from other *Calothamnus* species, including *C. superbus*, which occur nearer to or within the floristically diverse transitional rainfall zone of Western Australia where marked speciation has occurred (see Hopper 1979), suggests two things. Firstly, that petal indumentum is not required by *Calothamnus* species growing in marginal to higher rainfall areas, but may have significant adaptive value in the arid zone. Petal pubescence in *C. aridus* probably developed as a response to developing aridity since the separation of Australia and Antarctica. Secondly, based on our knowledge of the floristic anatomy and distribution of *Calothamnus*, the evolutionary relationship of *C. superbus* to *C. aridus* and to other members of the genus appears to be comprised of a number of lineages arising from a common ancestor, which reflect evolution in response to local and regional influences. Determination of the actual arrangement of lineages in *Calothamnus* would require a detailed cladistic analysis (e.g. Weston *et al.* 1984), which is beyond the scope of this paper. However, in a hypothetical cladogram it is likely that *C. superbus* and *C. aridus* would form a common clade, which is generally removed from all other species of *Calothamnus* presently known, apart perhaps for a tenuous link with *C. gilesii*.

Acknowledgements

We would like to thank Jim Armstrong, Neville Marchant and the staff of the Western Australian Herbarium (PERTH) for assistance in work associated with the preparation of this paper. The second author made the initial collection, the type, of *Calothamnus superbus* while employed on contract with the Department of Conservation and Land Management (CALM) on a survey of rare flora in CALM's Merredin District, a project funded jointly by the Australian National Parks and Wildlife Service and CALM. F. Mollemans wishes to acknowledge the funding bodies and to thank the project supervisors Dr D.J. Coates and Mr P. Brown for their support and encouragement during that project. Constructive criticisms by an anonymous referee pointed out aspects of this paper requiring improvement.

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A new species of *Guichenotia* (Sterculiaceae) from south western Australia

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Abstract

Keighery, Gregory, J. A new species of *Guichenotia* (Sterculiaceae) from south western Australia. Nuytsia 8(3): 319-321 (1992). A new species of *Guichenotia* is described: *G. alba* Keighery confined to heathland between Cataby and Three Springs north of Perth. A key to all species is included.

Introduction

Guichenotia J. Gay (Sterculiaceae) is a small genus of 7 species, all of which are confined to south western Australia. The genus is distinguished from the 7 other genera of the tribe Lasiopetalae by having leafy stipules (giving the leaves a whorl like appearance) and the sepals being prominently ribbed after flowering. Members of the genus also have distinctive pendant "bell like" flowers. Members of the genus are widely cultivated in Australia (Wrigley and Fagg 1979) and to a limited extent overseas. This distinctive taxon was segregated from the widespread *Guichenotia sarotes*, when the author sorted into single taxa the taxonomically poorly known groups recorded for the Mount Lesueur report. This species was listed in the subsequent report (Griffin *et al.* 1990) as *Guichenotia* sp. (E.A. Griffin 858). The purpose of this paper is to provide a valid name for this taxon.

Key to species of *Guichenotia*

- 1. Petals absent *G. apetala*
- 1. Petals present 2
- 2. Style glabrous in upper half 3
- 3. Stipules considerably smaller than leaves *G. angustifolia*
- 3. Stipules considerably larger than leaves..... 4
- 4. Raceme of 4-8 flowers, calyx c. 1 cm long *G. ledifolia*
- 4. Raceme of 1-3 flowers, calyx, 2-3 cm long *G. macrantha*

2. Style stellate-tomentose in upper half 5
5. Stipules leaf like, but smaller than leaves, calyx large, 10-15 cm long 6
5. Stipules small or absent, cordate, calyx small, 5-6 cm long *G. micrantha*
6. Flowers white; spreading (often almost prostrate) multi-stemmed shrub *G. alba*
6. Flowers pink; single-stemmed, erect shrub *G. sarotes*

Guichenotia alba Keighery sp. nov. (Figure 1)

Guichenotia alba Keighery; a *G. sarotes* flores alba decolor brunneolus, laxi-multi caulis e basi ramosae statim digressenda.

Typus: 5 kilometres south of Cataby, at the intersection of Mimmegarra road and the Brand Highway, Western Australia (30°45'S 115°30'E), 10 July 1988, *G.J. Keighery* 10270 (holo: PERTH; iso: CANB).

A slender lax few-branched *shrub*, multi-stemmed from a woody rootstock, stems to 40 cm long, plant to 10 cm tall. Young branches densely stellate-tomentose, becoming glabrous with age. *Leaves* alternate, petiole c. 0.5 mm long, lamina (9) 13-22 mm long with revolute margins, densely stellate-tomentose when young becoming glabrous and reticulately veined above. *Stipules* leaf-like, approximately 1/2-2/3 length of the leaves. *Racemes* simple, loose, in upper axils, 1-2 flowered, pedicel 6-9 mm, recurved, peduncle 3-6 mm, both densely stellate-tomentose. *Bracts* and *bracteoles* linear-obovate, apex acute. *Calyx* campanulate, white outside, pale green inside, lobes 11-13 cm long, with 3 central veins outside reticulate veined, stellate hairs on the veins, apex acute. *Petals* small and scale-like. *Stamens* 2-2.5 mm long, red-brown purple, apex pore area white. *Ovary* 1-1.5 mm long, covered with red glandular hairs. *Style* \pm 2 mm long, with a ring of stellate hairs below stigma. *Fruit* crustaceous, loculi are seeded, 4-5 mm diameter. *Seeds* pale brown, smooth, strophiolate, \pm 4 mm long.

Other specimens examined. WESTERN AUSTRALIA: Cockleshell Gully, *W.E. Blackall* 3554 (PERTH); Cockleshell Gully, *W.E. Blackall* 3619 (PERTH); Three Springs, *W.E. Blackall* 4390 (PERTH); Diamond of the Desert Spring, *C.A. Gardner* 9103 (PERTH); Cockleshell Gully to Lake Logue, *C.A. Gardner* 9382 (PERTH); One kilometre west of Brand Highway on Mimmegarra Road, *R. Hnatiuk* 1465 (PERTH); 3.5 kilometres east of Lake Indoon, *E.A. Griffin* 858 (PERTH).

Distribution. Restricted to the northern heathlands of southern Western Australia, between Three Springs and Cataby.

Habitat. *Guichenotia alba* grows in low open heath usually on sandy clay or duplex soils in depressions which are winter wet.

Flowering time. July to August. Mature fruits in November.

Conservation status. Not considered rare or endangered, but surveys are needed to determine this species occurrence in reserves in the region.

Affinities. This species is closely related to *G. sarotes* (under which the collections were previously placed), but can be immediately distinguished (when alive) by the white not pink flowers.

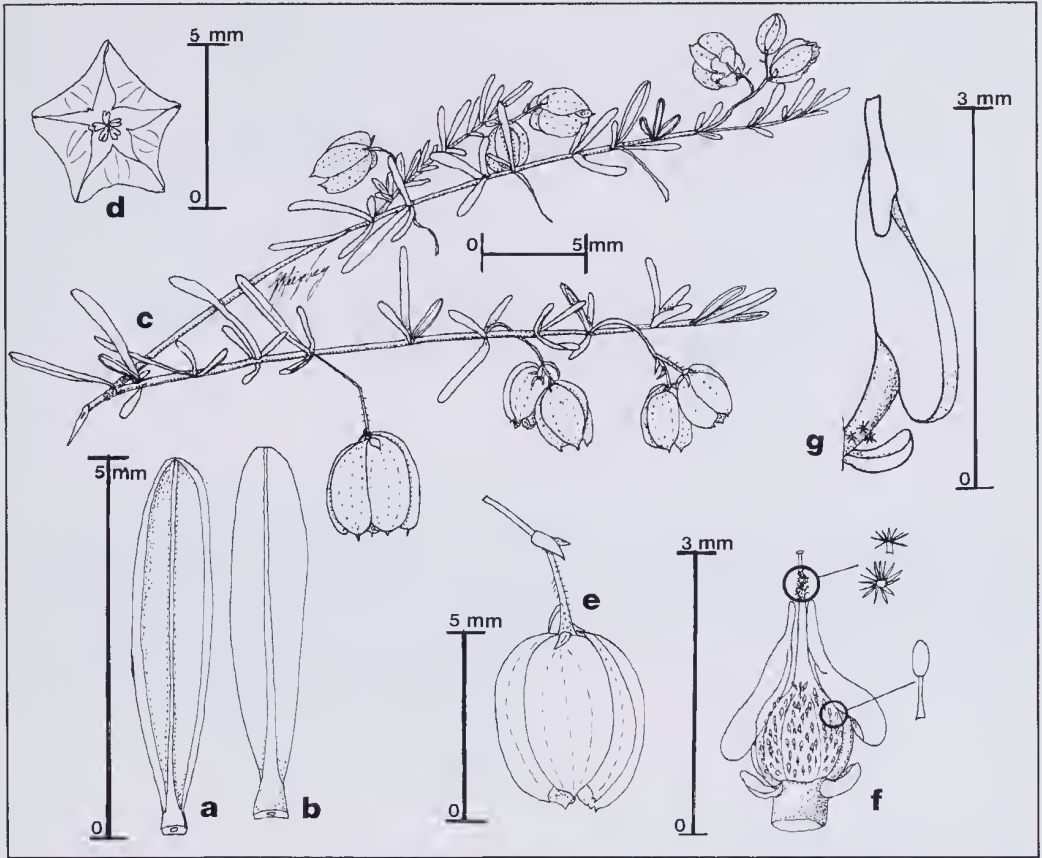


Figure 1. *Guichenotia alba* Keighery a - abaxial leaf surface, b - adaxial surface, c - habit, d - flower from below, e - flower, f - detail of flower with calyx removed, g - anther. Drawn from the type.

Additionally it differs in being an open, spreading (often almost prostrate) multi-stemmed shrub whereas *G. sarotes* is a single-stemmed erect shrub to 1.5 metres tall.

Etymology. The species name refers to the pale white flowers, which are unique for the genus.

Acknowledgements

The distinctiveness of this taxon was first recognised after it was collected during the *Banksia* sandplain survey by the W.A. Wildflower Society.

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Four new *Drosera* taxa from south western Australia

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Abstract

Lowrie, Allen and Marchant, Neville. Four new *Drosera* taxa from south western Australia. Nuytsia 8(3): 323-332 (1992). Three new species and one new subspecies of *Drosera* (Droseraceae) are described, *D. browniana* and *D. stolonifera* subsp. *monticola* (both tuberous *Drosera*) and *D. grievei* and *D. sargentii* (both pygmy *Drosera*), all endemic to south western Australia. The distinguishing characters of each are presented as well as their relationships and an indication of habitat preferences and conservation status.

Introduction

The south west of Western Australia is renowned for its richness of vascular plant species and its high degree of endemism. Fifty-four species of *Drosera* were recorded in Australia by Marchant and George (1982); of these, 42 species were then known to occur in the south west of Western Australia. The number of species now known to occur in this region is 68.

Since the publication of the first two volumes of Carnivorous Plants of Australia (Lowrie 1987, 1989), Allen Lowrie has made extensive field studies and has discovered a number of new *Drosera* taxa. As well as extensive field studies, he has propagated and cultivated all known species. Neville Marchant has made extensive herbarium studies including examination of almost all *Drosera* type specimens. In an endeavour to combine information from these varied sources the present authors have collaborated to circumscribe and publish new taxa.

Descriptions

1. *Drosera browniana* A. Lowrie & N. Marchant, sp. nov. (Figure 1)

Drosera bulbosa Hook. subsp. *bulbosa* affinis sed flore in statu fructificanti erecto, petalis obovatis apice truncato-crenato, extus roseis, intra albis, 7-10 mm longis, 4-6.5 mm latis.

Typus: 0.9 km south of the rock cairn on Hatters Hill goldmine, 0.1 km west of the road on the summit of a granite outcrop, Western Australia, Allen Lowrie 99, 2/9/90 (holo: PERTH; iso: MEL, RSA).

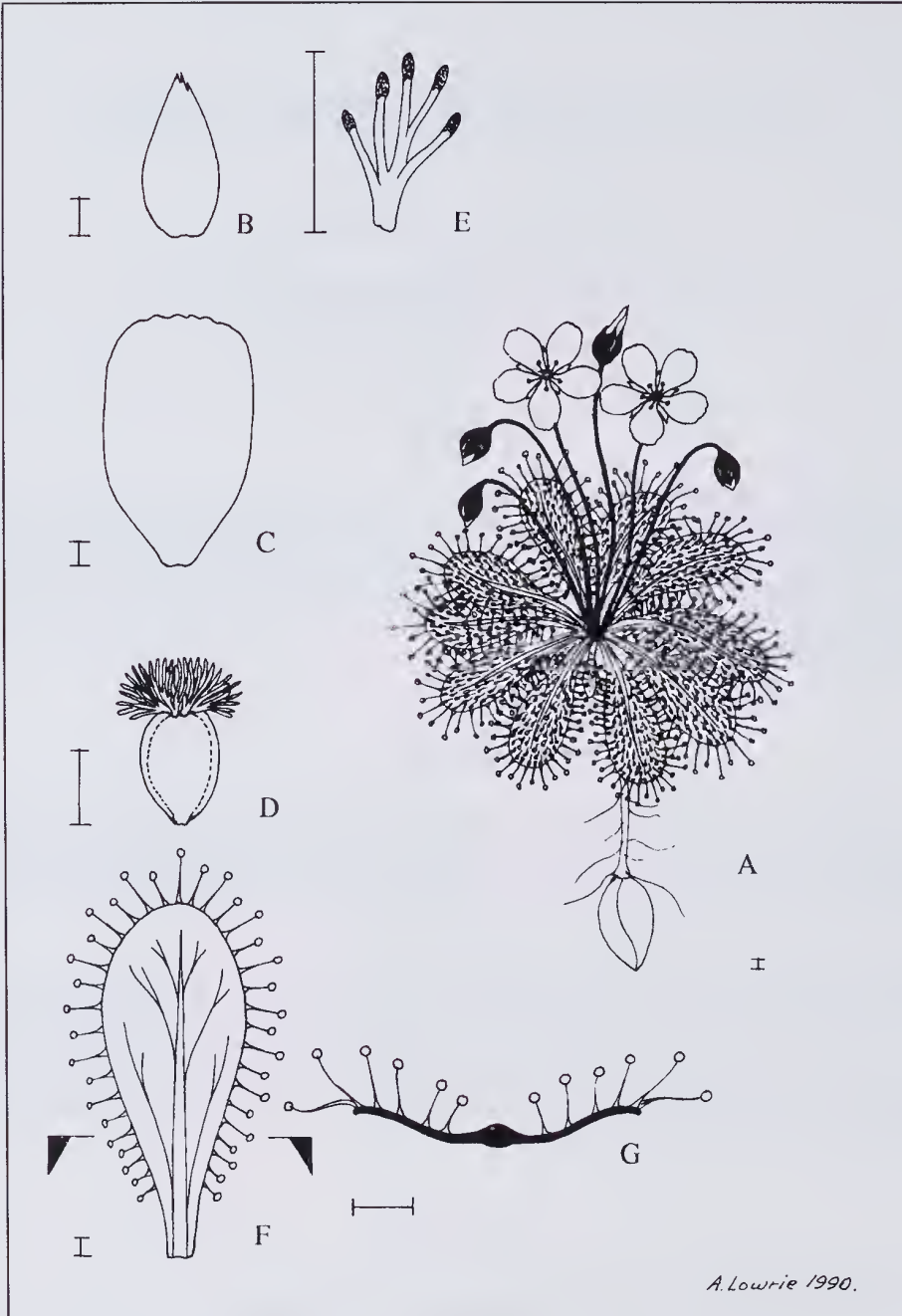


Figure 1. *Drosera browniana* A. Lowrie and N. Marchant
 A - mature plant in flower; B - sepal; C - petal; D - ovary with styles; E - part of style and stigmas, enlarged;
 F - leaf lamina; G - T.S. of leaf lamina as indicated on F. Scale bar for all = 1 mm

Tuberous herb. Underground stem 4-6 cm long. Leaves all in a flat basal rosette; lamina obovate, 18 mm long, 10-12 mm wide; petiole 7 mm long, 3 mm wide. Scapes 1-20, 4-10 cm long, single-flowered, erect in fruit. Calyx lobes ovate, united at the base, margin entire, apex serrate, 4.5 mm long, 2 mm wide. Petals distally pink, proximally white, obovate, apex truncate-crenate, 7-10 mm long, 4-6.5 mm wide. Ovary ovoid, 1.5 mm long and 1.3 mm in diameter at anthesis. Styles 3, 1 mm long, branched repeatedly from near the base into numerous filiform segments, forming a dense, rounded tuft; stigmas subclavate.

Affinities. *Drosera browniana* possesses a tuber with a vertical stolon with prophylls and a rosette of flat leaves with a broad petiole; stipules are absent. Thus, it belongs in *Drosera* subg. *Ergaleium* DC. sect. *Erythrorhizae* (Planchon) Diels.

D. macrophylla Lindley and *D. bulbosa* Hook. and its subspecies are morphologically similar to *D. browniana*. The three taxa can easily and reliably be differentiated by the characters which are presented in the following synoptic key:-

- 1. Leaves of the rosette up to 12 cm long at maturity
 - 2. Scapes 4-6-flowered; sepals entire *D. macrophylla*
 - 2. Scapes 1-flowered; sepals serrate *D. bulbosa* subsp. *major*
- 1. Leaves of the rosette less than 3 cm long at maturity
 - 3. Styles divided; scapes erect in fruit; petals pink and white; flowers August-September *D. browniana*
 - 3. Styles undivided; scapes secund in fruit; petals white; flowers May-June *D. bulbosa* subsp. *bulbosa*

Distribution. *Drosera browniana* is a widely scattered species and is quite common on soils associated with the narrow greenstone belt from Mt Holland (Lat. 32° 10'S, Long. 119° 44'E), to Hatters Hill (Lat. 32° 49' S, Long. 119° 59' E), a distance of 85 km.

Habitat and phenology. *Drosera browniana* grows in small depressions which are filled with brown loam soil on weathered granitic rock outcrops. The outcrops are generally only a metre or so higher than the surrounding country and are usually concealed in thickets of gimlet trees (*Eucalyptus* species). Rainfall in this region is generally low and restricted to late autumn and winter (May to August).

The leaves of *Drosera browniana* appear from the tubers in June and flowering occurs in August and September. In the dry period of the year *Drosera browniana* survives as dormant underground tubers until the onset of winter rains.

Other collections. WESTERN AUSTRALIA: Hatters Hill, intersection of pipeline track and main Hatters Hill bypass road. Western Australia, Lat. 32° 49' S, Long. 119° 59' E, *Paul G. Armstrong*, 24 Aug. 1990 (PERTH).

Conservation status. A relatively widespread species in native bushland east of cultivated areas and not under current threat.

Etymology. This species is named after Andrew Brown, an enthusiast of native orchids and officer of the Department of Conservation and Land Management who discovered the first population.

2. *Drosera stolonifera* Endl. subsp. *monticola* A. Lowrie & N. Marchant, subsp. nov. (Figure 2)

Typus: Summit of Toolbrunup Peak, Stirling Range National Park, *P. Mann* 14/11/89 (holo: PERTH).

Drosera stolonifera Endl. subsp. *compacta* N. Marchant affinis sed stolonibus et tuberibus hypogaeis in statu maturo persaepe praesentibus, caulis parte hypogaeis 3.5 cm longis, stolonibus adventitiis parum abbreviatis, petalis roseis usque ad 4 mm longis, ovario elliptico.

Tuberous herb with a vertical stolon up to 3.5 cm long which may branch to produce additional terminal tubers. Above ground stem more or less erect, 2-7 cm long; leaves basal and cauline, stem usually not developed in non-flowering specimens. Basal leaves rosetted, lamina spatulate, 4 mm long, 6 mm wide, more or less flat; petiole flattened, 4 mm long, 1.5 to 2 mm wide, dilated in upper part. Cauline leaves usually scattered, rarely sub-opposite or whorled, lamina flabellate, 5 mm long, 8 mm wide, distinctly concave; petiole 10 mm long, 1 mm wide, channelled above. Flowers terminal. Scape few-flowered, 5 cm long, glabrous; pedicels 8 mm long. Calyx lobes united at the base, ovate, 4 mm long, 2 mm wide, lower margin entire, upper margin and apex irregularly dentate-crenate. Petals obovate, 8 mm long, 5 mm wide, pale-pink with dark-pink closely spaced flabellate veining. Ovary ellipsoid, 1.3 mm long, 1.2 mm in diameter at anthesis. Styles 3, 0.8 mm long, each divided into many terete segments, half of them forming an irregular horizontally spreading whorl, the remainder erect; stigmas terete.

Distribution. *Drosera stolonifera* subsp. *monticola* is common on the summits of Toolbrunup Peak and Bluff Knoll. It is likely to occur on the summits of other peaks in the eastern part of the Stirling Range.

Habitat. Restricted to winter moist, black or brown loamy soils on ledges and in shallow depressions, often growing with moss. Only recorded from the upper slopes and summits which are frequently cloud-covered and are usually very moist.

Flowering period. Only recorded for November. The flowering period is probably between October and December.

Affinities. *Drosera stolonifera* subsp. *monticola* belongs in subg. *Ergaleium* DC. sect. *Stolonifera* DeBuhr because it possesses a tuber and has leaves in a basal rosette as well as cauline leaves.

Drosera stolonifera subsp. *compacta* N. Marchant is considered to be the taxon most similar to *Drosera stolonifera* subsp. *monticola*. The former subspecies occurs in heathland from the Stirling Range to the south coast and can be readily separated from the new subspecies by its flower colour, stolon morphology and petiole length. The morphological differences between the two taxa are presented in the following synoptic key:-

1. Petals pink; additional below-ground stolons and tubers
often present at maturity; petioles up to 4 mm long; ovary
ellipsoid *D. stolonifera* subsp. *monticola*
1. Petals white; additional below-ground stolons and tubers
absent, the lower stem prostrate; petioles 5-30 mm long;
ovary subglobose *D. stolonifera* subsp. *compacta*

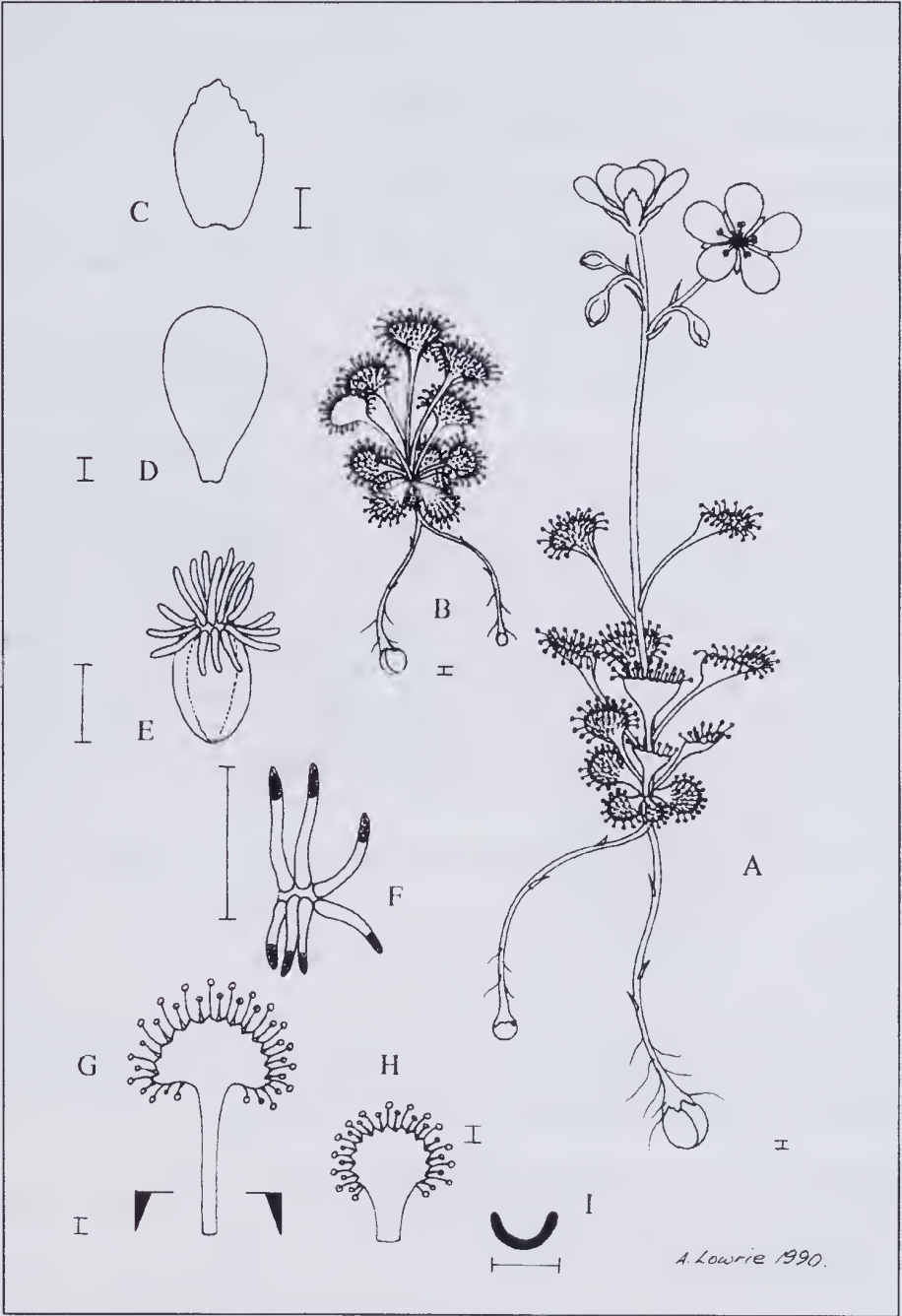


Figure 2. *Drosera stolonifera* subsp. *monticola* A. Lowrie and N. Marchant
A - mature plant in flower; B - mature non-flowering plant; C - sepal; D - petal; E - ovary with styles;
F - part of style and stigmas, enlarged; G - cauline leaf lamina; H - basal leaf lamina; I - T.S. of cauline
leaf petiole as indicated on G. Scale bar for all = 1 mm

Conservation status. Relatively common in the Stirling Range National Park where it is apparently not under threat.

Etymology. This new subspecies is restricted to the upper parts of the Stirling Range hence the epithet, *monticola*, referring to its mountain habitat.

3. *Drosera grieveri* A. Lowrie & N. Marchant, sp. nov. (Figure 3)

Drosera paleacea DC. subsp. *paleacea* affinis sed scapo uno usque ad 3 cm longo, 5-10-floris, sepalis perlato-obovatis 2.5 mm longis, 2.5 mm latis.

Typus: At the east end of Baanga Hill road, near the junction of Sennetts Lake Road, c. 20 km east of Lake King township, Western Australia, *Allen Lowrie* 25/9/89 (holo: PERTH; iso: MEL).

Fibrous rooted herb forming a compact convex rosette to 1.2 cm diameter. Stem to 2 cm long, covered with the withered remains of the previous seasons growth. Leaves 20-30. Lamina orbicular, subpeltate, 0.7 mm diameter; petiole 3.6 mm long, 0.5 mm wide at the base, dilated to 0.8 mm wide in the lower part, 0.2 mm wide at the apex. Stipule bud ovoid, 3 mm long, 2 mm diameter, with setae. Stipules 3-lobed, 5 mm long, 4 mm wide; the central lobe divided into 2 segments, each segment in turn divided into two segments narrowing to setae, lateral lobes with a short segment on the outer margin near the base, and two asymmetrically bifurcate apical lobes. Inflorescence racemose; scape 1, to 3 cm long, covered with minute short broad glands; flowers 5 to 10; pedicels 2.5 mm long, semi-erect in fruit. Calyx lobes very broadly obovate, united at the base, 2.5 mm long, 2.5 mm wide, apex irregularly dentate. Petals white, oblong, 4.0-4.5 mm long, 2 mm wide. Ovary turbinate, 0.7 mm long, 1 mm diameter at anthesis. Styles 4, spreading horizontally, 0.5 mm long, 0.1 mm diameter; stigmas falcate, 1.2 mm long, 0.15 mm diameter, apex subacute. (Figure 3)

Distribution. Known only from two locations, 30 km apart, in the eastern wheatbelt south-east of Hyden.

Habitat. In clayey sand on heathland under and between low shrubs.

Affinities. *D. grieveri* belongs in *Drosera* subg. *Rorella* (DC.) Diels, sect. *Lamprolepis* Planchon because it has rosetted leaves, prominent stipules, many-flowered scapes and it reproduces by propagules. *D. paleacea* DC. subsp. *paleacea* is considered the closest relative of *Drosera grieveri* but differs from it in the features presented in the synoptic key below:-

- 1. Scapes 5-10-flowered; sepals very broadly obovate, 2.5 mm long, 2.5 mm wide. Petals oblong, 4-4.5 mm long *D. grieveri*
- 1. Scapes 30 or more-flowered; sepals obovate, 1.5 mm long, 0.7 mm wide. Petals obovate, 3-4 mm long *D. paleacea* subsp. *paleacea*

Conservation status. Threatened. Currently known from only two roadside locations in an area which has been extensively cleared for farmland.

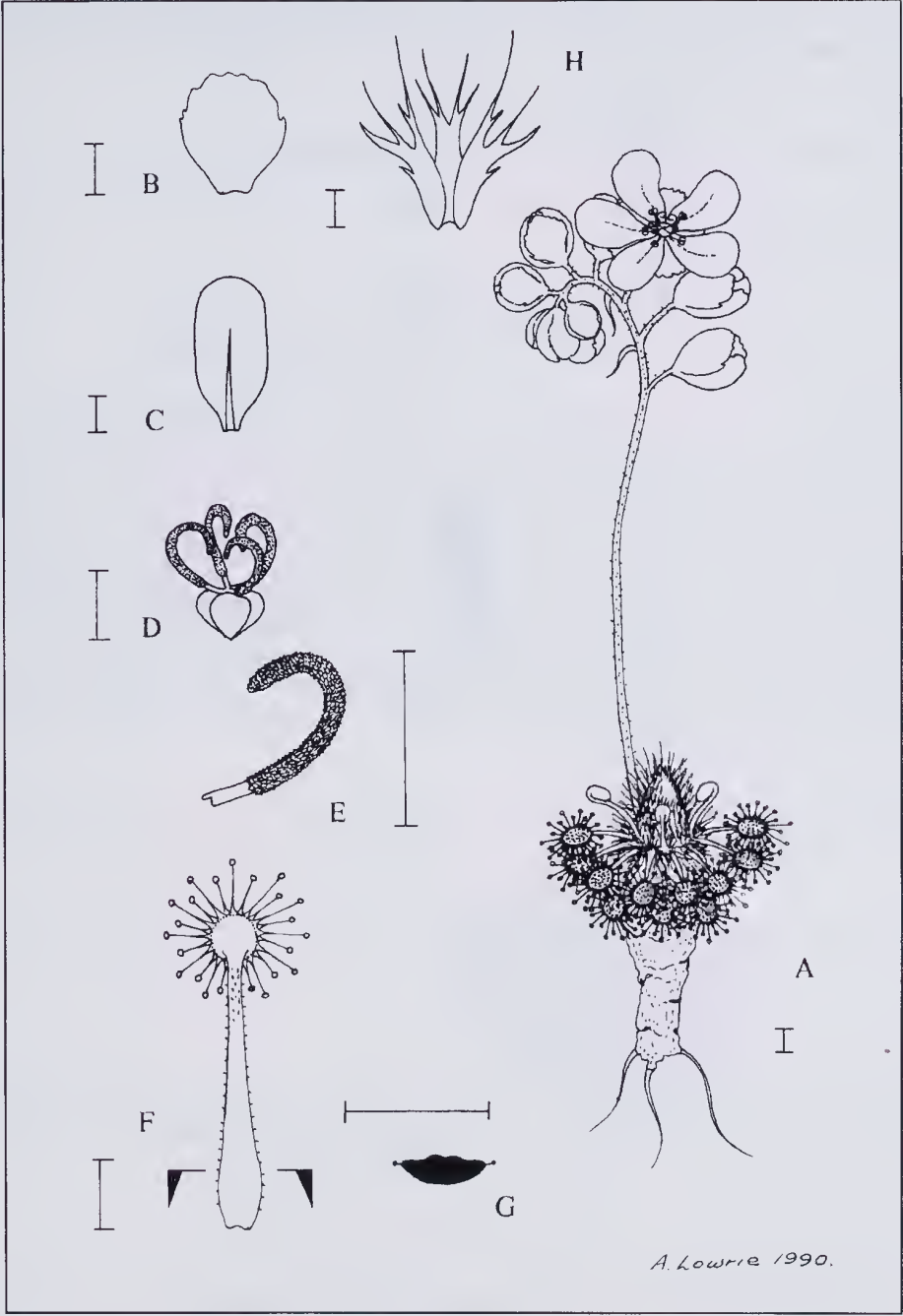


Figure 3. *Drosera grievei* A. Lowrie and N. Marchant
A - mature plant in flower; B - sepal; C - petal; D - ovary with styles; E - part of style and stigma, enlarged.
F - leaf lamina; G - T.S. of leaf petiole as indicated on F. Scale bar for all = 1 mm

Etymology. *Drosera grievii* is named in honor of Brian James Grieve (1907-), Professor Emeritus, who has provided the only comprehensive means of identifying the rich flora of southern Western Australia. From 1954 Professor Grieve has produced the outstanding series of books "How to Know Western Australian Wildflowers".

4. *Drosera sargentii* A. Lowrie & N. Marchant, sp. nov. (Figure 4)

Drosera parvula Planchon affinis sed stipula-gemma conicis, 6 mm longa, 4 mm diam., setis longissimis dense obtectis.

Typus: At the junction of Stockyard Road and Merivale Road, in the S.E. corner, c. 20 km E of Esperance, Western Australia, *Allen Lowrie* 22/11/89 (holo: PERTH; iso: MEL).

Fibrous rooted herb forming a compact convex rosette up to 1.5 cm diameter. Stem to 2 cm long, covered with the withered remains of the previous seasons growth. Leaves 20-50. Lamina orbicular, almost peltate, 0.8 mm diameter; petiole 3.8 mm long, 0.5 mm wide from the base for a third of the length, the upper part 0.2 mm wide. Stipule bud conical, 6 mm long, 4 mm diameter, with extremely long setae. Stipules shortly 3-lobed, 1.5 mm long, 1.7 mm wide, lobes truncate, the central lobe with 5 short fringes, the lateral lobes with 3 short fringes and a 5 mm long seta adjacent to the mid-lobe. Inflorescence racemose; scapes 1 to 2, up to 5 cm long, glabrous; flowers 20 to 40; pedicels 1 mm long, pendulous in fruit. Calyx lobes glabrous, ovate, united at the base, 1.5 mm long, 0.9 mm wide, margin entire, apex slightly serrate, Petals white, obovate, 3 mm long, 2 mm wide, entire. Ovary obovoid, 0.4 mm long, 0.5 mm diameter at anthesis. Styles 3, white, semi-erect, 0.3 mm long, 0.1 mm diameter; stigmas white, falcate-clavate, 1.1 mm long, 0.1 mm diameter at the base, dilated to 0.15 mm diameter near the rounded apex.

Distribution. *Drosera sargentii* is a common species in the coastal regions between Esperance and Cape Le Grand National Park.

Habitat. In deep, white siliceous soil on heathland. At many locations it grows with the widespread, white-flowered species *Drosera scorpioides*.

Flowering period. November-December.

Affinities. *D. sargentii* belongs in *Drosera* subg. *Rorella* (DC.) Diels, section *Lamprolepis* Planchon because it has rosetted leaves, prominent stipules, many-flowered scapes and it reproduces by propagules. *D. parvula* Planchon is considered here to be species most similar to *Drosera sargentii*. The two taxa differ in the features presented in the following synoptic key:-

1. Stipule bud forming a conical tuft, densely covered with extremely long setae; pedicels pendulous in fruit; sepals 1.5 mm long; petals 3 mm long *D. sargentii*
1. Stipule bud forming an ovoid tuft, with short setae covering the lower part and long setae at the apex; pedicels semi-erect in fruit; sepals 3-4 mm long; petals 4-6 mm long *D. parvula*

Conservation status. A common and apparently widespread species not under current threat.

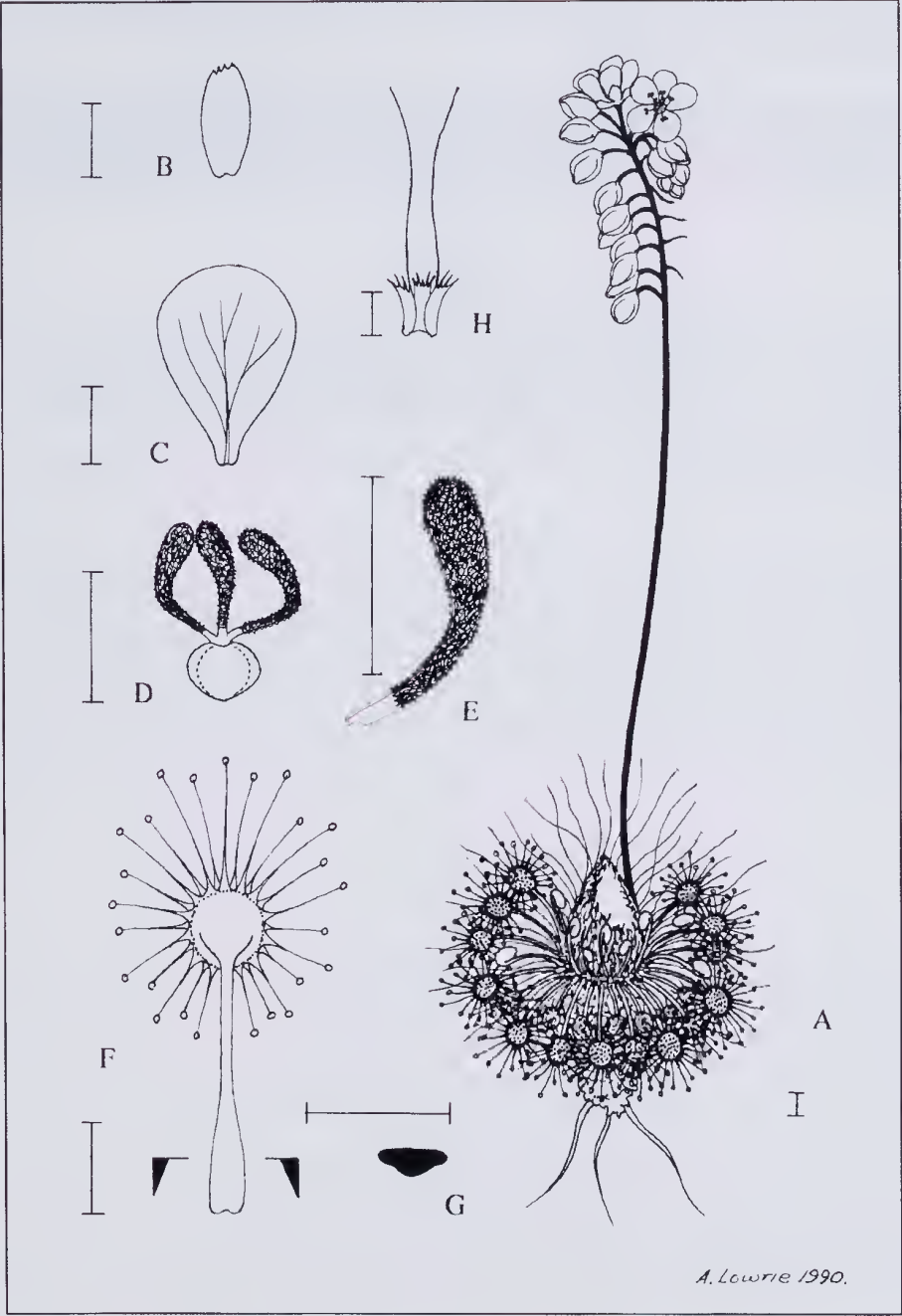


Figure 4. *Drosera sargentii* A. Lowrie and N. Marchant
A - mature plant in flower; B - sepal; C - petal; D - ovary with styles; E - part of style and stigma, enlarged;
F - leaf lamina; G - T.S. of leaf petiole as indicated on F. Scale bar for all = 1 mm

Etymology. *Drosera sargentii* is named in honour of Oswald Hewlett Sargent (1880-1952), a Pharmacist of York, Western Australia, who made a major contribution to Western Australian botany including studies on the genus *Drosera*.

This new species of pygmy sundew was discovered by Allen Lowrie and Steve Rose in 1988 when it had just finished flowering. The following season, flowering specimens were found and brought into cultivation for closer study.

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New names and combinations for some *Melaleuca* (Myrtaceae) species and subspecies from the south-west of Western Australia considered rare or threatened

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Abstract

F.C. Quinn, K.J. Cowley, B.A. Barlow and K.R. Thiele. New names and combinations for some *Melaleuca* (Myrtaceae) species and subspecies from the south-west of Western Australia considered rare or threatened. Nuytsia 8(3): 333-350 (1992). The paper describes or makes new combinations for several species and subspecies of *Melaleuca* considered to be rare or threatened. Six species and two subspecies, *Melaleuca araucarioides*, *M. fissurata*, *M. ordinifolia*, *M. pomphostoma*, *M. ringens*, *M. sculponeata*, *M. viminea* subsp. *appressa* and *M. huegelii* subsp. *pristicensis* are described as new. *M. tenella* Benthham is reduced to a subspecies of *M. incana* R. Br. and *M. densa* var. *pritzelii* Domin is raised to specific rank.

Introduction

Like many other medium-sized and large genera of the Autochthonous Sub-element of the Australian flora, *Melaleuca* has a major centre of species richness in the Southwest Botanical Province of Western Australia. It is probable that the genus comprises 250-300 species, of which about half probably occur in the Southwest Botanical Province. As a consequence, much of the systematic research necessary to provide a comprehensive inventory of the genus is concentrated on this region. Our research indicates that many of the species in this area have relatively small distribution areas.

Among the many taxa which have been distinguished, there are several which appear to require documentation as rare or threatened. The purpose of this paper is to make names available for a number of these species and subspecies, as a step in expediting full documentation of the conservation status of each. Some of these have already been listed, as undescribed species, in the work on rare or threatened Australian plants by Briggs and Leigh (1988). Others are recognised as new for the first time in this paper, and conservation codes are suggested for them also.

The recommendations for conservation status suggested here are in accordance with the criteria set out by Briggs and Leigh (1988). With respect to the species dealt with here, the following designations are relevant:

Code	Explanation
2	geographic range less than 100 km
3	geographic range more than 100 km
K	poorly known
C	population reserved
E	endangered
V	vulnerable
-	adequacy of reserve unknown

Of the ten taxa dealt with in this paper, the codes which have been suggested include 2K (1 taxon), 2KC- (1), 2E (2), 2V (1), 3K (2), 3KC (1), and 3KC- (2).

All of the species and subspecies dealt with here occur in the Southwest Botanical Province of Western Australia. The four letter codes used in qualifying the geographic occurrences of the taxa refer to the natural regions of Australia delineated by Barlow (1987). These codes are useful in quantifying the distributions of plant species on an Australia-wide basis. Because these taxa all occur in an area where there is now a very complex mosaic of natural vegetation and cleared agricultural land, there is clearly an urgent need for additional field work in order to clarify the conservation status of each taxon.

Taxonomy

The taxa dealt with below have been arranged in alphabetical order. Because our revision of *Melaleuca* is still in progress, we have not yet finalised an infra-generic classification of the genus. The classification of Bentham (1867) appears to be artificial, and we have therefore avoided referring species to Bentham's sections. The taxa dealt with here belong to a number of distinct species groups within the genus. These species groups all have geographic distributions which are essentially temperate Australian. They also all have centres of species richness in the south west province of Western Australia.

1. *Melaleuca araucarioides* Barlow, sp. nov. (Figure 1a)

Species nova *M. blairiifoliae* Turcz. proxima, sed foliis ternatis, stylis brevioribus, fructibus plerumque minoribus differt.

Holotypus: Western Australia: Esperance Region: About 1 km W of Kog's Corner on the Cape Riche to Highway road, 34°36'S 118°45'E, Cowley & Quinn 151, 7.x.1988 (CANB 383935). *Isotypi*: BRI, K, MEL, PERTH.

Shrub to 1.5 m high, young shoots lanuginose and the rachis occasionally tomentose, otherwise glabrous. Leaves ternate, semi-appressed and crowded in 6 regular rows along the axis; lamina narrowly elliptic to narrowly obovate, slightly rounded abaxially and flat or channelled adaxially, 1.7-3.5 mm long, 0.7-1.8 mm wide, obtuse and inflexed at the apex, slightly reflexed and attenuate at the base into a petiole 0.3-0.8 mm long; venation obscure; glands obscure or slightly pustulate. Inflorescence a basal or terminal spike or head of 8-17 crowded monads, to 10 mm long, terminal heads often predominantly male flowers; bracts 0.8-1.3 mm long, 0.4-0.8 mm wide, persistent to flower

senescence. Hypanthium cup-shaped, rounded at the base, 0.8–1.2 mm long. Sepals 0.5–0.8 mm long, membranous at the margin, persistent to mature fruits. Stamens 1.8–5 mm long including a claw 0.8–1.4 mm long, 3–4(5) per bundle, filaments cream to yellow. Style to 5.5 mm long; ovules c. 22 per loculus. Fruits shortly bell-shaped, compressed by mutual pressure, 2.5–3.5 mm long, 2–4.3 mm diam. with thickened, rounded and outspread persistent sepals.

Distribution and ecology. Confined to the Ongcrup-Cape Riche area, NW of Albany (ESPR) with a geographic range on current knowledge of less than 100 km. Occurs in well drained sandy or loamy soils in heaths or open eucalypt woodlands. Flowering has been recorded in July and October. Figure 2a.

Distinction from related species. *Melaleuca araucarioides* is closely related to *M. blaeriifolia*, from which it can readily be distinguished by its ternate phyllotaxy, shorter style and smaller fruits. In *M. blaeriifolia* the style is 8–9 mm long and the fruits are 3.5–5 mm in diameter and 3.5–4 mm long. The very regular arrangement of the leaves into 6 rows is particularly distinctive.

Conservation status. We recommend that the conservation status of this species should be Poorly Known (code 2K of Briggs and Leigh 1988) as it is only known from eight collections, only two of which have been made in the last fifteen years. It also appears to be geographically restricted and from our field observations is probably rare.

Etymology. The specific epithet alludes to the superficial resemblance of the leafy shoots to those of the gymnosperm genus *Araucaria* Juss.

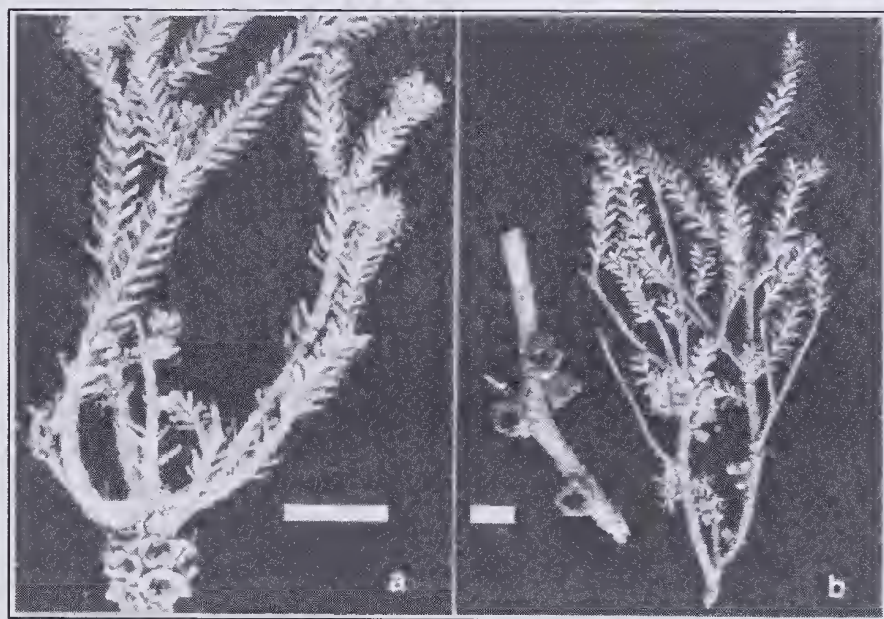


Figure 1. a, *Melaleuca araucarioides*, portion of plant (Cowley & Quinn 151). b, *M. fissurata*, portions of plant (left piece, van der Moezel PGV120; right piece, Wilson 7000). Scale bars = 1 cm

Additional specimens examined. WESTERN AUSTRALIA: c. 6 km S of Jerramungup on road to Albany, *Cowley & Quinn* 146, 7.x.1988 (CANB); 10 miles (16 km) N of Cape Riche, *Gardner s.n.*, 12.x.1942 (PERTH); 8 miles (13 km) SE of Ongerup, *Newbey* 1277, 12.vii.1964 (PERTH); 10 km S of Boxwood Hills, *Newbey* 4264, 19.vii.1974 (PERTH); Kojaneerup East Road, *Pfeiffer s.n.*, 18.vii.1969 (PERTH); cultivated at Glenmorgan, Qld, from seed collected at Cape Riche, *Gordon* 2358, x.1962 (PERTH); Nova Hollandia, *Drummond* 5th coll. 167, no date (KW, photo in CANB).

2. *Melaleuca fissurata* Barlow, sp. nov. (Figure 1b)

Species nova *M. lateriflorae* Benth. proxima, sed fructibus aspri fissuratis, foliis carinatis retroflexis brevioribus differt.

Holotypus: Western Australia: Esperance Region: 29 km SSW of Tadpole Lake, c. 65 km ENE of Lake King, 32°32'S 119°54'E, *Newbey* 5535, 13.viii.1979 (PERTH).

Low shrub to 1.5 m tall, rough-barked, the inflorescence minutely pubescent, otherwise glabrous. Leaves spirally arranged, spreading; lamina broadly elliptic, somewhat thickened and keeled abaxially, 4.0-5.0 mm long, 1.5-2.0 mm wide, obtuse at the apex, broadly tapering to a stout petiole 0.5-0.7 mm long, veinless or with 1-2 faint, fine lateral veins on either side of the keel; glands obscure or prominent, scattered. Inflorescence a lateral cluster of 1-5(10) flowers on old wood; bracts ovate, c. 1 mm long, c. 0.8 mm wide, persistent to anthesis. Hypanthium broadly cup-shaped, 1.2-1.5 mm long, glabrous, smooth or verrucose. Sepals rounded-triangular, 1.2-1.4 mm long, deciduous before fruit maturity. Stamens white, 5.0-10.0 mm long including a broad claw c. 1.5 mm long, 10-12 per bundle. Style c. 5.5 mm long; ovules not seen. Fruit cup-shaped, c. 4 mm long, 5.5-8.0 mm diam. with a rough, fissured, dark bark-like surface; valves enclosed.

Distribution and ecology. Known from Mt Ney to Lake King, N of Esperance in the South West Botanical Province of Western Australia with a geographic range on current knowledge of c. 260 km. Occurs in shrub mallee or woodland on sand or sandy loam usually over clay or clay loam. Flowering is predominantly in July and August. (Figure 2b)

Distinction from related species. *Melaleuca fissurata* is most closely related to *M. lateriflora* differing markedly in its very roughly textured, fissured, corky fruit and keeled, retroflexed, shorter leaves. *M. lateriflora* has erect, sometimes slightly channelled leaves (5)7-20(25) mm long. The two species overlap for a small part of their ranges but, maintain their morphological distinction, reinforcing the appropriateness of specific rank for *Melaleuca fissurata*.

Conservation status. We support Briggs and Leigh (1988) who cited this species as *M. sp. 2* (Mt. Ney-Lake King) in assigning a conservation status of Poorly Known (code 3K) as it is only known from 7 collections. This species appears to occur in small populations in apparently localised and specific habitats making it very vulnerable to disturbance. Further field work is needed to confirm its status, particularly to examine whether or not the Lake King population is disjunct from other known populations.

Etymology. The specific epithet is derived from the Latin *fissuratus* (fissured) and refers to the surface texture of the fruit.

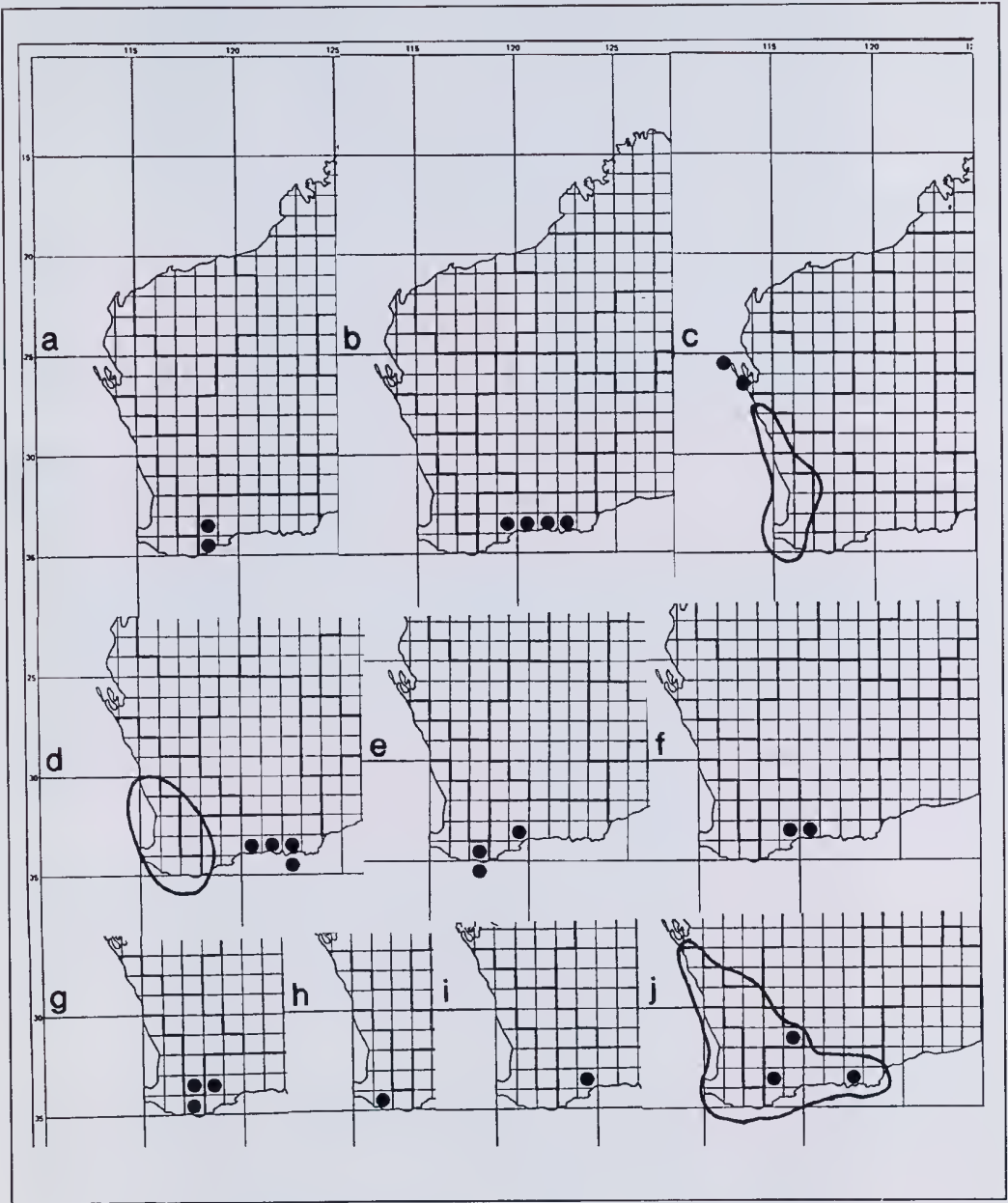


Figure 2. Distributions of the species shown as occurrences in 1° cells. a, *M. araucarioides*. b, *M. fissurata*. c, *M. huegelii* subsp. *pristicensis* with the outline showing the range of the typical species. d, *M. incana* subsp. *tenella* with the outline showing the range of the typical species. e, *M. ordinifolia*. f, *M. pomphostoma*. g, *M. pritzelii*. h, *M. ringens*. i, *M. sculponeata*. j, *M. viminea* subsp. *appressa* with the outline showing the range of the typical species.

Additional specimens examined. WESTERN AUSTRALIA: 33 km WSW of Lake King township, Wilson 7000, 10.viii.1968 (CANB, PERTH); 13 km ENE of Scadden on Cox Rd, *van der Moezel s.n.*, 1.vii.1984 (PERTH); Ridley Rd, 5.4 km from Ridley-Truslove Rd junction, c. 20 km NE of Scadden, *van der Moezel* 120, 17-18.viii.1982 (CANB, PERTH); 9.2 km due SSW of Mt Ridley, *Burgman & McNee* 1863, 8.viii.1983 (PERTH); 15 km due SW of Mt Ney, 5 km NE of Burdett Rd on Mt Ney Rd, *Burgman & McNee* 1657, 3.viii.1983 (CANB, PERTH); 30.75 km N of Mt Beaumont, 9.58 km NW of Mt Ney Rd on Clyde Rock Rd, *Burgman & Layman* 3061, no date (PERTH).

3. *Melaleuca huegelii* subsp. *pritscensis* Barlow, subsp. nov. (Figures 3a-e)

Subspecies nova *M. huegelii* Endl. subsp. *huegelii* proxima, sed rhachidi brevior, floribus malvinis paucioribus differt.

Holotypus: Western Australia: Murchison Region: Tamala Station, 26°42'S 113°43'E, *Beard* 6800, 11.x.1973 (PERTH). *Isotypi*: PERTH, CANB.

Spreading shrub or tree 0.9-2 (rarely to 5) m tall, inflorescence axis pubescent at flower bases only and the bracteoles, hypanthium, anthers and stems with few long hairs, otherwise glabrous. Leaves spirally arranged; lamina ovate or triangular, flat to weakly keeled, 1.8-4.0 mm long, 1.5-2.5 mm wide, acute to acuminate at the apex, slightly contracted and sessile or weakly peltate at the base; veins several, sometimes obscure; glands fine, in rows. Inflorescence subbasal on lateral stems or terminal on main axes, a spike of 1-12 triads spirally arranged on an axis (5)10-20(30) mm long; triads with the central flower higher than the laterals, forming a triangular group; bracts broadly triangular, c. 2.5 mm long, c. 2 mm wide, foliose, green to scarious, deciduous; bracteoles narrowly triangular, c. 1.5 mm long, (0.2)0.6-1.2 mm wide, deciduous. Hypanthium cup-shaped, c. 2 mm long, c. 2 mm wide, ribbed. Sepals triangular, 0.8-1.0 mm long, persistent to mature fruit. Stamens mauve to pink, 2-3 mm long including a claw 3-5 mm long and 0.5-0.6 mm wide, 9-13 per bundle. Style 8-9 mm long; ovules c. 12 per loculus. Fruit globular, c. 3 mm long, 3.5-4.0 mm diam., weakly lobed, smooth to papery in texture; valves deeply recessed.

Distribution and ecology. Restricted to Dirk Hartog Island and around Tamala Station, in the south end of Shark Bay in South West Botanical Province of Western Australia (MRCH). Although this subspecies has a geographic range on current knowledge of more than 100 km, existing records show that the distribution may be disjunct. It occurs in heathlands in sand. Flowering is predominantly in September and October. (Figure 2c)

Distinction as a subspecies. In *M. huegelii*, the triangular rather than linear arrangement of the flowers in each triad is distinctive, and the species may be more closely related to other species which have this pattern, including *M. adnata* Turcz. and *M. eleuterostachya* F. Muell., than with other species having more or less peltate leaves. The populations from the northern part of the range can be readily distinguished in several characters. Strong ecogeographic divergence is indicated, and two subspecies have been distinguished accordingly. The new subspecies differs consistently from the typical one in its much shorter and fewer-flowered inflorescence, and in the mauve to pink rather than white or cream staminal filaments. The typical *M. huegelii* has inflorescence axes of (25)40-80(130) mm and usually 50-140 triads in each flower spike. The sharp distinction between the two subspecies suggests that substantial genetic divergence has occurred. The differences shown by subsp. *pritscensis* are presumably adaptive, reflecting a lower level of resource allocation to seed production and perhaps a different pollinator.

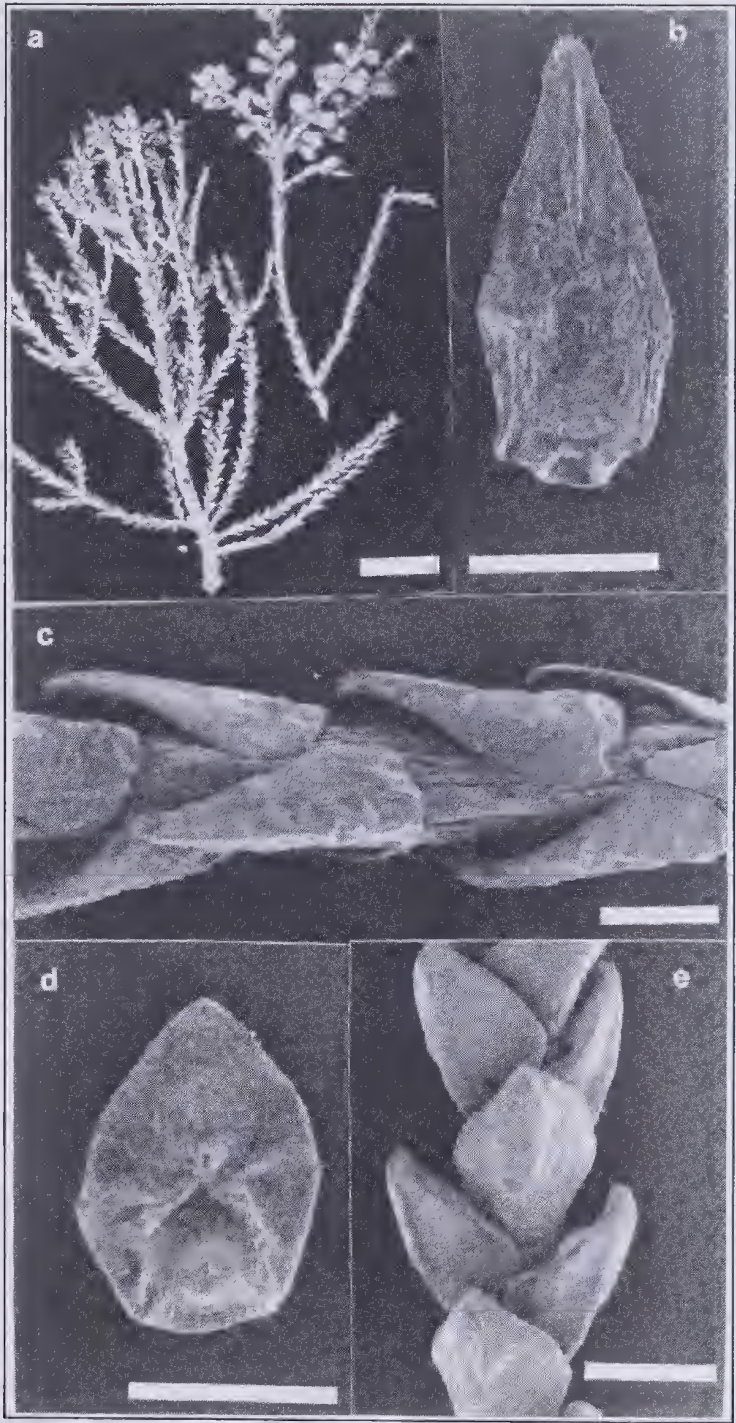


Figure 3. *Melaleuca huagelii* subsp. *pristicensis*. a, portions of plant (George 11566). b-e, Scanning Electron Micrographs (SEMs), showing variations in leaf form. b, abaxial surface of leaf from indeterminate shoot (George 11566). c, indeterminate shoot (George 11566). d, abaxial surface of leaf from lateral shoot (George 11566). e, lateral shoot (George 11566). Scale bars = 1 cm

Conservation status. We recommend that the conservation status of this species should be Poorly Known (code 3K of Briggs and Leigh, 1988). Even though the geographic range for this species is more than 100 km, it seems to occur only in small populations at each locality in apparently localised and specific habitats.

Etymology. The subspecific epithet is derived from *pristix* (shark) and refers to its occurrence in the Shark Bay area.

Additional specimens examined. WESTERN AUSTRALIA: MRCH: just S of Cape Inscription, Dirk Hartog Island, *George* 11566, 5.ix.1972 (CANB, K, MEL); inland of Sandy Point, Dirk Hartog Island, *Beard* 7091, 18.x.1974 (PERTH); between Carrarang and Tamala, *Beard* 7079, 16.x.1974 (PERTH); 16 miles SW of Tamala, *Demarz* 5169, 8.ix.1974 (PERTH); 22 km on Tamala Rd, *Demarz* 8998, 2.x.1981 (PERTH); 3 miles W of Tamala, *Davies s.n.*, 13.x.1960 (PERTH).

4. *Melaleuca incana* subsp. *tenella* (Bentham) Barlow, comb. et stat. nov. (Figure 4a)

Melaleuca tenella Bentham, Fl. Aust. 3:160 (1867); *Myrtoleucodendron tenellum* (Bentham) Kuntze, Revis. Gen. Pl. 241 (1891). *Type:* Western Australia: Phillips River, *Maxwell s.n.* (holo: K; iso: CANB, MEL 602187, MEL 602188).

Shrub 1 m, the inflorescence axis tomentose, otherwise glabrous. Leaves ternate or displaced ternate, often slightly keeled, reflexed from the petiole and incurved towards the axis; lamina narrowly ovate, flat to compressed, (3.5)7-9 mm long, 0.5-0.9 mm wide, obtuse and often thickened at the apex, attenuate at the base into a petiole 0.5-1 mm long; venation obscure or only the midvein evident; glands 10-15 on the abaxial surface towards the centre of the lamina, uniformly large. Inflorescence a basal or terminal spike or head of 10-35 crowded monads, 5-25 mm long, with the terminal heads often predominantly of male flowers; bracts 1.2-2 mm long, 0.9-1.3 mm wide, persistent to anthesis. Hypanthium cylindrical with an elongated base in hermaphrodite flowers, conical in male flowers, 1.5-2 mm long. Sepals 0.5-0.7 mm long, membranous at the margins, persistent to mature fruit. Stamens 3.5-6 mm long including a claw 0.5-1 mm long, (3)4-8(10) per bundle with filaments white to yellow. Style 5-8 mm long; ovules c. 25-32 per loculus. Fruits shortly bell-shaped with an elongated base, sometimes compressed by mutual pressure, 1.8-4 mm long, 3-5 mm diam., with persistent rounded thickened outspread sepals.

Distribution and ecology. Found on the coast and in adjacent inland areas from near Esperance to Cape Le Grande National Park in the south-west of Western Australia (ESPR). Associated with swampy and moist areas. Flowering is from August to October. (Figure 2d)

Distinction as a subspecies. There is a disjunction in the distribution of *M. incana* which corresponds closely with the occurrence of two distinct morphological forms (Figure 2d). Whilst the more easterly of these was described as a distinct species, *M. tenella*, by Bentham, the differences appear to be relatively minor consequences of ecogeographical divergence, and there is some evidence of introgression (see below). The two entities are accordingly treated as subspecies. *Melaleuca incana* subsp. *tenella* differs from subsp. *incana* in the glabrous, smaller leaves, as well as in having slightly shorter stamens, more obscure venation and fewer leaf glands, as summarized in the description above. *M. incana* subsp. *incana* usually has pubescent leaves that are (3.5)7-15(17) mm long and 1-1.5(3) mm wide and have c. 40-100 small and c. 20 larger leaf glands, while the stamens range from (3.5)6-8.5 mm long.

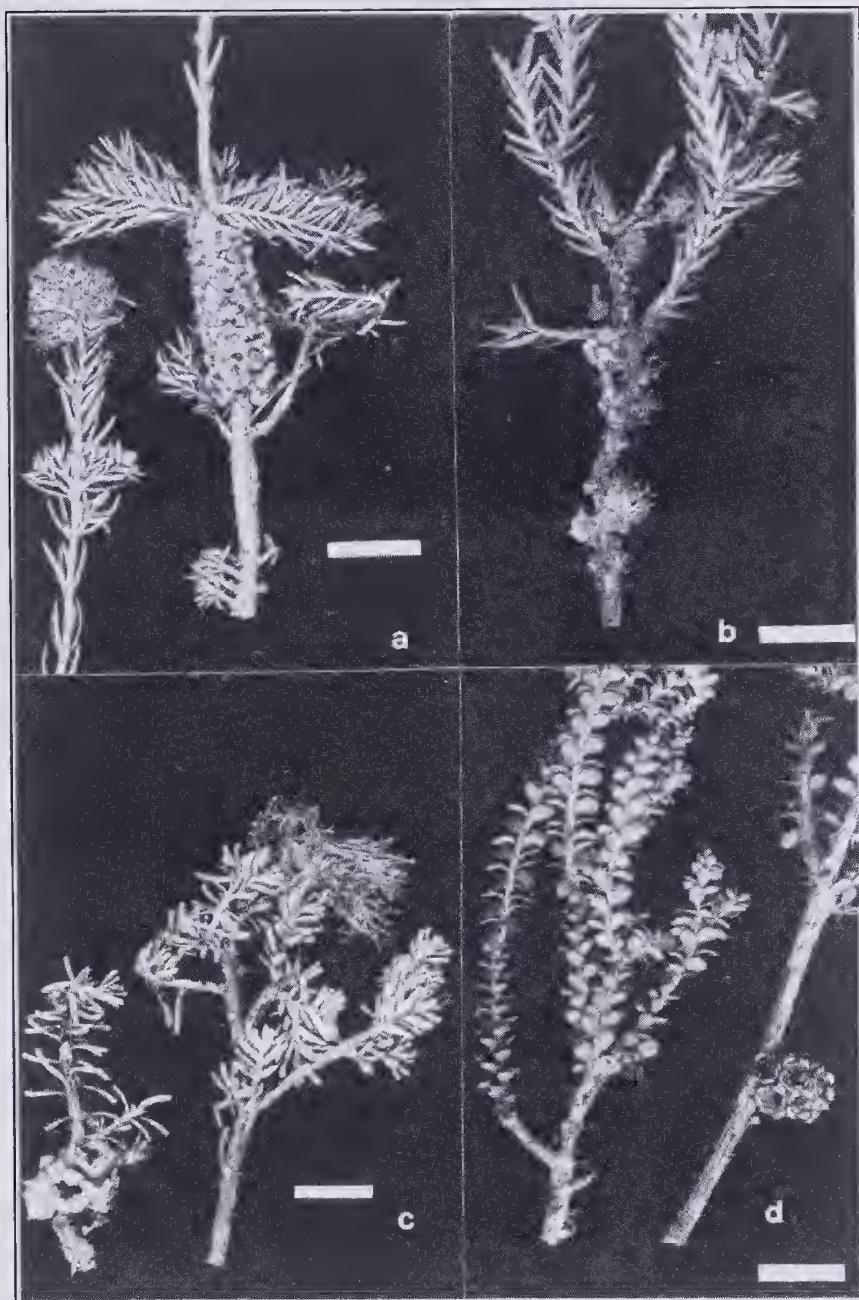


Figure 4. a, *Melaleuca incana* subsp. *tenella*, portions of plant (Jackson 1273). b, *M. ordinifolia*, portion of plant (Burbidge 2457). c, *M. pomphostoma*, portions of plants (flowering piece, Wittwer 415; fruiting piece, Newbey 4913). d, *M. pritzelii*, portion of plant (Cowley & Quinn 108). Scale bars = 1 cm

There are a few collections from within the geographical range of *M. incana* subsp. *incana* which resemble *M. incana* subsp. *tenella*. However, they all show minor differences from the morphology of subsp. *tenella* in its disjunct eastern area, and have not been included in this subspecies. It is possible that the divergence of the two subspecies is relatively old, and may have had a different geographical basis from that which now distinguishes them. Whilst it may not be relevant to this hypothesis, it is notable that the type localities of *M. incana* and its subsp. *tenella* are both outside the known present-day ranges of the two subspecies as indicated by more recent collections.

Misapplied name. The name *M. microphylla* has sometimes been misapplied to *M. incana* subsp. *tenella*, which differs from that species in its tomentose rachis and ternate leaves.

Conservation status. We recommend the conservation status of this subspecies should be Poorly Known (code 2KC- of Briggs and Leigh, 1988) on the basis that there are herbarium specimens collected from proclaimed reserves but from populations of unknown size. *Melaleuca incana* subsp. *tenella* is poorly known and appears to have a restricted geographic range. This subspecies is known to be represented by populations within a national park and another reserve, though the adequacy of reservation is unknown.

Additional specimens examined. WESTERN AUSTRALIA: ESRP: 0.4 km N of Fisheries Rd on Coolinup Rd, Reserve 27354, *Burgman* 4407, x.1984 (PERTH); c. 50 km E of Esperance, *Kuchel* 1674, 11.ix.1964 (AD, CANB); 7 miles from Esperance at junction of Ravensthorpe and Norseman roads, *Wrigley s.n.*, 2.xi.1968 (CBG); 6 miles N of Esperance, *leg. ign. s.n.*, 18.ix.1950 (AD); Buyi Billanak Homestead, c. 12 km SE of Condingup Peak, *Jackson* 1273, 21.ix.1968 (CANB); 3 km N of Duke of Orleans Bay, *Wilson* 8108, 30.ix.1968 (CANB, PERTH); N of Mount Le Grand, *Eichler* 21229, 11.ix.1971 (CANB, AD); near "yate" swamp, 3.4 miles E of Cape Le Grand National rd, N of Lucky Bay, *Weston* 9576, 3.x.1974 (CANB, PERTH); Cape Le Grande, *Lullfitz* 3565, 23.viii.1964 (PERTH); between Cape Le Grande and Lucky Bay, *Gardner* 14120, 2.ix.1962 (CANB, PERTH).

5. *Melaleuca ordinifolia* Barlow, sp. nov. (Figure 4b)

Species nova *M. apodocephalae* Turcz. proxima, sed foliis decussatis brevioribus, inflorescentiis monadibus paucioribus bracteis minoribus, sepalis longioribus, staminibus longioribus pluribus differt.

Holotypus: Western Australia: Esperance Region: near Hamersley River crossing, Ongerup-Ravensthorpe road, 33°46'S 119°36'E, *Newbey* 5075, 28.ix.1977 (CANB 313531). *Isotypi:* CANB, PERTH.

Low shrub usually less than 1 m tall, the young shoots moderately pubescent with crisped hairs and soon glabrescent and the inflorescence axis and hypanthium white-pubescent, otherwise glabrous. Leaves decussate, nearly erect at 30°, crowded in 4 regular longitudinal series; lamina narrowly ovate, compressed concavo-convex, straight or slightly incurved, (4.0)4.5-5.5(7.0) mm long, 1.0-1.5 mm wide, obtuse at the apex, slightly contracted at the base into a stout petiole c. 0.5 mm long; veins and glands obscure. Inflorescence a lateral cluster of 1-3 flowers on old wood; bracts triangular to ovate, to 1.5 mm long and 1.0 mm wide, persistent to anthesis. Hypanthium broadly cylindric, c. 1.5 mm long. Sepals obtusely triangular, thick, erect, c. 1.0 mm long, deciduous before fruit maturity. Stamens white, 5.0-5.5 mm long including a very short claw c. 0.5 mm long, 8-12 per bundle. Style 6.5-7.5 mm long;

ovules 27-31 per loculus. Fruit shortly cup-shaped, 3-4 mm long, 4-5 mm diam., dark-coloured, somewhat rough and fissured below a papery epidermis, slightly sinuate and not narrowed at the aperture; valves enclosed.

Distribution and ecology. Found in the south-west of Western Australia from Cranbrook to the Hammersley River (LUWN, ESPR). The range is possibly disjunct. Occurs in mallee shrubland on loams and elays. Flowering is predominantly from August to October. (Figure 2c)

Distinction from related species. *Melaleuca ordinifolia* is probably closely related to *M. apodocephala* and *M. brevifolia* Turcz., although the latter two have spiral phyllotaxy while the former has decussate phyllotaxy. *Melaleuca ordinifolia* is entirely sympatric with *M. brevifolia* and with *M. apodocephala* subsp. *apodocephala*, and appears to completely maintain its identity in the field. It is readily distinguished from most other decussate-leaved species by its short, compressed, channelled leaves crowded into four regular rows and by its rough-textured fruit surface.

Conservation status. We recommend that the conservation status of this species, listed by Briggs and Leigh (1988) as *M. sp. 1* (Cranbrook-Hammersley River), should be Poorly Known (code 3KC- of Briggs and Leigh, 1988) on the basis of a herbarium specimen collected from Stirling Range National Park but from a population of unknown size. Although *Melaleuca ordinifolia* appears to have a geographic range more than 100 km, it seems to only occur in highly specific and localised habitats. Of the 7 collections seen there is only one collection since 1977 and this was from the Stirling Range National Park.

Etymology. The specific epithet is derived from the Latin *ordinis* (methodical arrangement) and alludes to the regular arrangement of the leaves.

Additional specimens examined. WESTERN AUSTRALIA: LUWN; near Pootenup, *Newbey* 1861, 24.ix.1965 (PERTH); E from Solomons Well, Stirling Range, *Morrison s.n.*, 28.ix.1902 (PERTH); sandplain S of Pootenup, *Burbidge* 2457, 11.ix.1947 (CANB); Cranbrook, *Diels s.n.*, no date (PERTH); c. 500 m W of junction of Salt River Rd with Red Gum Pass Rd on Salt River Rd, Stirling Range National Park, *Cowley & Quinn* 169, 9.x.1988 (CANB); cultivated at Glenmorgan, Qld, from seed collected at Albany, W.A., *Gordon* 6040, x.1962 (PERTH).

6. *Melaleuca pomphostoma* Barlow, sp. nov. (Figures 4c)

Species nova *M. bracteosae* Turcz. proxima, sed stomatibus prominentibus staminibus pluribus longioribus unguic staminum longiore stylo longiore differt.

Holotypus: Western Australia: Esperance Region: Below W end of Eyre Range, c. 33°51' 119°59', *George* 9296 (PERTH). *Isotypus:* CANB.

Dense shrub to 1.5 m high, young shoots and rachis tomentose, and branchlets minutely lanuginose, otherwise glabrous. Bark grey, rough and thick. Leaves spirally arranged, spreading; lamina narrowly elliptical to narrowly ovate, compressed especially towards the apex, (3)5-8(10) mm long, 1-2 mm wide, covered with very numerous white pustulate stomata, obtuse at the apex, attenuate at the base into a petiole 0.5-1 mm long; venation obscure; glands obscure. Inflorescence a basal or terminal spike of up to 10 crowded monads, up to 15 mm long; bracts and bracteoles to 1 mm long and 1 mm wide, persistent to anthesis. Hypanthium cylindrical with a somewhat elongated base, 2.5-3

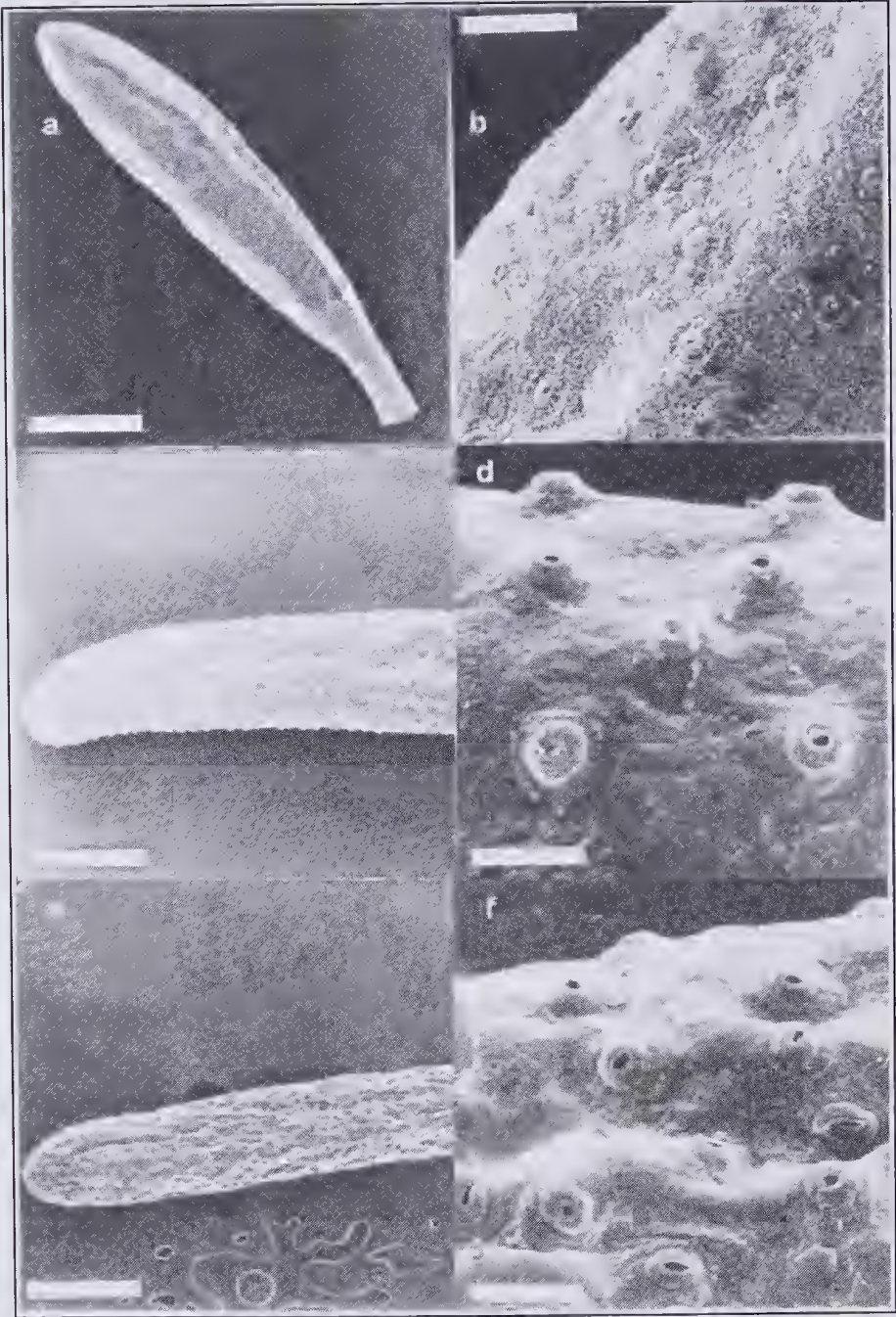


Figure 5. SEMs showing leaf surface characters. a, c, e, abaxial whole leaf surface. b, d, f, abaxial leaf surface showing stomata. a, b, *M. bracteosa* (Barlow 4231). c, d, *M. pomphostoma* (George 9296). e, f, *M. bracteosa* x *M. pomphostoma* (Short, Amarena & Fuller 2696). Scale bars = 1 cm

mm long. Sepals 1-1.5 mm long, membranous at the margins, persistent to mature fruits. Stamens (8) 10-14 mm long including a claw 4.5-8 mm long, 12-18 per bundle, with filaments greenish-yellow. Style 9-15 mm long; ovules 30-50 per loculus. Fruits broadly bell-shaped with an elongated base, sometimes compressed by mutual pressure, 3-5 mm long, 4-7 mm diam., usually with thickened and outspread sepals.

Distribution and ecology. Distributed in a small area in south-western Western Australia, near Ravensthorpe and the Eyre Range, with most of the collections being from the eastern end of Fitzgerald River National Park (ESPR). Flowering has been recorded in April, May and August. (Figure 2f)

Distinction from related species. *Melaleuca pomphostoma* is most closely related to *M. bracteosa* and differs from that species mainly in its conspicuous stomata, more numerous, longer stamens and different leaf shape. Although barely visible with a hand lens, the differences between the stomata of *M. pomphostoma* and *M. bracteosa* are striking and consistent. One putative hybrid has been recorded between *M. pomphostoma* and *M. bracteosa*, and the stomata of that specimen are intermediate between the two putative parents (Figure 5). *M. bracteosa* has (3) 7-11 stamens per bundle and they are 3.5-5 mm long. Its keeled leaves range from being very narrowly elliptic to very narrowly obovate.

Conservation status. We recommend that the conservation status of this species should be Poorly Known (code 2KC- of Briggs and Leigh, 1988) on the basis of herbarium specimens collected from Fitzgerald River National Park but from populations of unknown size. The species is known from only 6 collections and has a geographic range of less than 100 km. It is represented by populations within a national park, although adequacy of reservation is unknown.

Etymology. The specific epithet is derived from the Greek *pomphos* (blister) and *stoma* (mouth), and alludes to the distinctive pustular stomata on the lamina.

Additional specimens examined. WESTERN AUSTRALIA: ESPR: 1.9 km E of jctn of Moir Rd & Track joining Ravensthorpe/Hopetoun Rd, c. 7 km S of Ravensthorpe, Fox 86/168, 6.ii.1986 (CANB); Ravensthorpe, cultivated in Qld by D.M. Gordon, Gray 2129, 1961 (PERTH); Phillips River Reserve, Eyre and Whoogarup Range Area, Kessell 870, 20.v.1969 (PERTH); 7 km W of East Mt Barren, Newbey 4913, 2.xi.1975 (PERTH); 98 (28?) miles from Ravensthorpe, Wittwer 415, 27.viii.1965 (PERTH).

7. *Melaleuca pritzelii* (Domin) Barlow, comb. et stat. nov. (Figure 4d)

Melaleuca densa var. *pritzelii* Domin, Mem. Soc. R. Sci. Boheme (Vestn. Kral. Ceske Spolecn. Nauk) 2: 90 (1923). Type: NW Plantaginet, in arenosis, Pritzel 696 (holo: ?PR, not seen; iso: BRI 230687, E, K, PERTH).

Shrub to 1.2 m tall, with the inflorescence axis and hypanthium tomentose and young shoots tomentose soon glabrescent, otherwise glabrous. Leaves decussate and sometimes ternate, strongly spreading; lamina broadly ovate or sometimes obovate, flat but keeled, 1.2-2.5(4.1) mm long, 1.2-2.0(3.5) mm wide, acute at the apex, sessile; midvein sometimes prominent but venation obscure; glands punctate. Inflorescence lateral on old wood or terminal (usually male flowers only), a cluster of 10-15 flowers with axis rarely growing on after anthesis; bracts broadly ovate, 1.6-2.0 mm long,

0.8-1.3 mm wide, early deciduous. Hypanthium funnel-shaped, 1.4-1.9 mm long. Sepals transversely ovate, scarious, glandular, 0.8-1.0 mm long, persistent to mature fruit. Stamens light cream, 3.6-6.5 mm long including a claw (1.2)1.5-2.5 mm long, 2-4 per bundle. Style 5.5-8.2 mm long; ovules 22-27 per loculus. Fruit cup-shaped, 2.0-2.4 mm long, 3.6-4.0 mm diam., papery in texture; valves deeply recessed below the aperture.

Distribution and ecology. Distributed in south-western Western Australia from near Ongerup to near Pootenup (BENC, LUWN, ESPR). Occurs in mallee heath or tall shrubland on shallow, poorly drained sands over clay. Flowering occurs in August and September. (Figure 2g)

Distinction from related species. *Melaleuca pritzelii* is probably not closely related to *M. densa* R.Br. even though Domin first described it as a variety of the latter species. It is quite distinctive in its combination of leaf and inflorescence characters and its status as a distinct species is clearly indicated.

Conservation status. We support Briggs & Leigh (1988) who cited this species as *M. sp. 4* (Ongerup and Pootenup) in assigning a conservation status to this species of Endangered (code 2E). An extensive search in 1986 by B.A.B. in an area near Ongerup revealed only 2 plants. At other sites visited by F.C.Q. and K.J.C. in 1988 only one or a few plants were found. As each of the populations is apparently limited to a few plants, the risk of this species disappearing altogether is very high.

Additional specimens examined. WESTERN AUSTRALIA: BENC: 19 km E Katanning, *Cole & McDonald* 2011H, 15.ii.1986 (CANB); 19 km E of Katanning on Douglas Rd towards Nyabing, *Cowley & Quinn* 108, 3.x.1988 (CANB). LUWN: Gordon River, Tambellup, *Newing s.n.*, i.1964 (PERTH); near Pootenup, *Newbey* 1862, 24.ix.1965 (PERTH); 11-14 km by road from Kendenup on Red Gum Pass Rd, *Barlow* 4228, 24.x.1986 (CANB); c. 10.3 km S of Stirling Range Rd junction with Red Gum Pass Rd on Red Gum Pass Rd., *Cowley & Quinn* 168, 9.x.1988 (CANB). ESPR: 11-13 km E of Ongerup, *Barlow* 4268, 25.x.1986 (CANB); 11 km E of Ongerup, *Newbey* 4781, 5.ix.1975 (PERTH); 23 km E of Ongerup, *Newbey* 4292, 15.viii.1974 (CANB, PERTH); 7.5 miles NE of Ongerup, *Newbey* 342, 19.viii.1962 (PERTH); 10 miles E of Ongerup, *Newbey* 383, 26.viii.1962 (PERTH).

8. *Melaleuca ringens* Barlow, sp. nov. (Figure 6a)

Species nova *M. vimineae* Lindley proxima, sed unguibus staminum brevioribus, ramulis tomentosis, inflorescentiis semper terminalibus, foliis plerumque latioribus differt.

Holotypus: Western Australia: Lccuwin Region: Point d'Entrecasteaux, 300 m below the lighthouse, 34°50'S 116°00'E, *Cowley & Quinn* 183, 10.x.1988 (CANB 383963). *Isotypi:* AD, BRI, G, K, MEL, PERTH.

Shrub to 3 m high, the rachis and young shoots tomentose, the stems sparsely pubescent, otherwise glabrous. Leaves spirally arranged, densely crowded and spreading; lamina elliptic, flat, 4.5-6.6 mm long, 1.8-3.0 mm wide, obtuse to almost acute at the apex, truncate at the base with a petiole 0.9-1.1 mm long; midvein distinct with other venation obscure; glands obscure. Inflorescence of 10-60 monads densely arranged into terminal spikes 9-30 mm long; bracts 1.5-2.5 mm long, 1.0-1.5 mm wide, early deciduous. Hypanthium cylindrical with an elongated base, c. 1.8 mm long. Sepals 0.8-1.0 mm long, entire or narrowly membranous at the margins, persistent to mature fruit. Stamens 4.8-7.0 mm long including a claw 0.9-1.3 mm long, 7-11 per bundle with filaments cream. Style 8-11 mm

long; ovules 20-25 per loculus. Fruits cylindrical to bell-shaped, compressed by mutual pressure, 4-5 mm long, 4-7 mm diam., with thickened erect or outspread sepals.

Distribution and ecology. Known only from Point d'Entrecasteaux, Western Australia (LUWN). Occurs in sands over limestone on exposed high ridges or clifftops. Flowering has been recorded in September and October. (Figure 2h)

Distinction from related species. *Melaleuca ringens* is probably closely related to *M. viminea* from which it differs in its strictly terminal inflorescences, shorter staminal claw, tomentose branchlets and wider leaves. *M. viminea* has leaves 0.6-2.0 mm wide and a staminal claw of more than 1.5 mm long. *Melaleuca ringens* also resembles some specimens of *M. densa*, but can be distinguished by its spiral leaves and strictly terminal inflorescences.

Conservation status. We recommend that the conservation status of this species should be Vulnerable (code 2V of Briggs and Leigh, 1988). Due to its very limited known distribution (only found at Point d'Entrecasteaux), *M. ringens* may be vulnerable to localised threats. The species should, however, be further surveyed in an effort to locate additional populations.

Etymology. The specific epithet is derived from the Latin *ringens* (gaping), and refers to the very open fruit aperture.

Additional specimens examined. WESTERN AUSTRALIA: LUWN: Point D'Entrecasteaux, at the lighthouse, Cowley & Quinn 183A, 10.x.1988 (CANB); Point D'Entrecasteaux, at the lighthouse, Eichler 23052, 22.viii.1982 (CANB, PERTH); Point D'Entrecasteaux, along the road to the lighthouse just below the top of the hill, Eichler 23054, 22.ix.1982 (CANB); locality not known, voucher for compatibility tests PERTH Oct. 1984, parent #28, Kenneally s.n. (= Barlow 3835), 9.x.1984 (CANB); Point D'Entrecasteaux, Newbey 3152, 31.i.1968 (PERTH); cultivated from seed collected from Point d'Entrecasteaux, Newbey 3655, 4.xi.1972 (PERTH).

9. *Melaleuca sculponeata* Barlow, sp. nov. (Figures 6b, c)

Species nova *M. brevifoliae* Turcz. proxima, sed foliis decussatis basi peltatis, glandulis non prominentibus differt.

Holotypus: Western Australia: Esperance Region: "Giraween" farm, c. 65 km W of Ravensthorpe, 33°27'S 119°20'E, Hnatiuk 800128, 3.x.1980 (PERTH).

Shrub 0.4 m tall, lignotubercous, multistemmed, the young shoots tomentose and the inflorescence axis with short crisped hairs, otherwise glabrous. Leaves decussate, erect; lamina narrowly elliptic or oblong, convex abaxially, concave adaxially, 1.9-3.1 mm long, 0.8-1.1 mm wide, obtuse or very shortly mucronate at the apex, obtuse at the base, sessile and attached peltately near the base; venation obscure; glands 6-8 visible on the abaxial surface, more or less in two rows, not prominent. Inflorescence a lateral cluster of c. 10 flowers on old wood. Fruit depressed-globular, slightly compressed by mutual pressure, 2-2.5 mm long, 3-4 mm diam., smooth, contracted and entire at the aperture, 2- or 3-locular with 25-30 seeds per loculus; valves deeply enclosed. Other characters unknown.

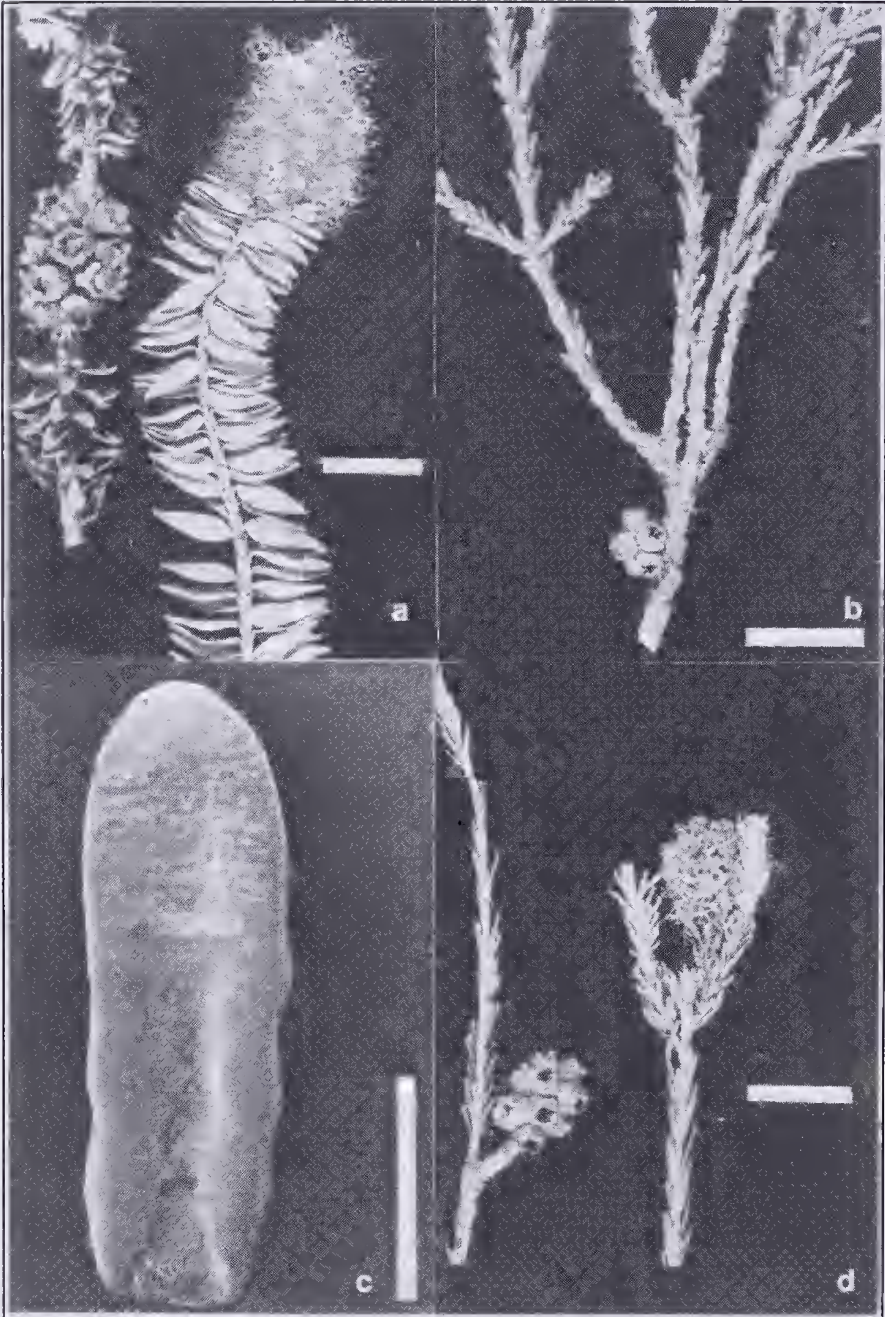


Figure 6. a, *Melaleuca ringens*, portions of plants (flowering piece, Eichler 23054; fruiting piece, Cowley & Quinn 183A). b,c, *M. sculponeata*. b, portion of plant (Hnatiuk 800128). c, SEM showing abaxial surface of leaf (Hnatiuk 800128). d, *M. viminea* subsp. *appressa*, portions of plant (Newbey 4864). Scale bars = 1 cm

Distribution and ecology. Known from the type locality only, near Ravensthorpe (ESPR). Recorded from regenerating mallee heath on light grey sand over clay. (Figure 2i)

Distinction from related species. Although known only from a single non-flowering specimen, *M. sculponeata* appears to be distinct from all other species in the genus in its combination of peltate leaves (Figure 6c) and determinate lateral inflorescences. It is possibly allied to *M. brevifolia*, differing in the decussate, peltate leaves which do not have prominent, raised glands.

Conservation status. We recommend that the conservation code for this species, listed by Briggs and Leigh (1988) as *M. sp. 3* (W of Ravensthorpe), should be Endangered (code 2E of Briggs and Leigh, 1988). *Melaleuca sculponeata* is known from only one locality on a roadside verge surrounded by wheatfields. It is from an area reasonably well explored botanically and now extensively cleared for agricultural purposes, and therefore is under serious threat owing to loss of habitat.

Etymology. The specific epithet is derived from the Latin *sculponea* and alludes to the resemblance of the detached leaf to the shape of a wooden shoe.

10. *Melaleuca viminea* subsp. *appressa* Barlow, subsp. nov. (Figure 6d)

Subspecies nova *M. vimineae* Lindley subsp. *vimineae* proxima, sed foliis aggregatis appressis apicibus inflexis, staminibus brevioribus, stylis brevioribus differt.

Holotypus: Western Australia: Esperance Region: 16 km E of Ongerup, 33°57'S 118°37'E, *Newbey* 4864, 21.x.1975 (CANB 285751).

Shrub 1.3-4.5 m high, the young shoots sparsely lanuginose, the hypanthium and rachis usually tomentose, otherwise usually glabrous. Leaves spiral (rarely ternate), moderately densely arranged, appressed; lamina linear to narrowly elliptic or narrowly ovate, flat or slightly compressed, 5-9 mm long, 0.6-2.0 mm wide; obtuse and slightly inflexed at the apex; attenuate at the base into a petiole 0.8-1.2 mm long; venation usually obscure, rarely with the midvein evident; glands usually obscure, rarely pustulate. Inflorescence of 10-50 monads relatively densely arranged into both long basal spikes and terminal spikes or heads, 8-40(50) mm long, often with the terminal heads predominantly of male flowers; bracts 1.5-4 mm long, 1-2 mm wide, persistent to anthesis. Hypanthium cylindrical with an elongated base in hermaphrodite flowers, conical in male flowers, 1-2.5 mm long. Sepals triangular, 0.5-1 mm long, membranous at the margins, sometimes persistent in mature fruit. Stamens 5-5.5 mm long including a claw 2-3 mm long, (5)8-11(13) per bundle, with filaments cream. Style 6-7 mm long; ovules 50-80 per loculus. Fruits shortly cylindrical to bell-shaped, 3-4 mm long, 2-4 mm diam., bluntly toothed at the rim.

Distribution and ecology. Known from near Ongerup, Mt Burdett and NW of Skeleton Rock (BENC, ESPR), with a possibly disjunct distribution. Occurs near creeks or wet depressions in clayey soils, possibly associated with granite. Flowering has been recorded in September and October. (Figure 2j)

Distinction as a subspecies. *Melaleuca viminea* is an extremely variable species. Much of this variation has no clear geographic basis, and is presumably the result of an unusual level of heterozygosity for morphological character states. However, within the total range of variation two more or less homogeneous entities with individual geographic integrity stand out from the general residual range of polymorphy, and three subspecies have accordingly been recognised. One of these,

described here as subsp. *appressa*, is considered to merit coding as a threatened taxon. *Melaleuca viminea* subsp. *appressa* differs from the other subspecies by its appressed leaves which are incurved at the apex, and its distinctly shorter floral parts. The collection from Mt Burdett has slightly shorter, wider leaves which are more incurved at the apex than the other collections, but is clearly referable to this subspecies.

Conservation status. We recommend that the conservation status of this subspecies should be Poorly Known (code 3KC- of Briggs and Leigh, 1988) on the basis of a herbarium specimen collected from Mt Burdett Nature Reserve but from a population of unknown size. Subspecies *appressa* is known from only 4 collections and has a possibly disjunct distribution over more than 100 km. One population occurs within a proclaimed Nature Reserve although adequacy of reservation is unknown.

Etymology. The subspecific epithet is derived from the Latin *appressus*, and refers to the appressed leaves of this taxon.

Additional specimens examined. WESTERN AUSTRALIA: BENC: c. 2 km SW of junction of Emu Fence Road and Brennand Road, *Barlow & Fox* 4133, 8.x.1986 (CANB). ESPR: c. 1 km past sign for Mt Burdett Nature Reserve on road to Mt Burdett & Mt Wittcnoom (Kendall's Road), *Cowley & Quinn* 35, 28.ix.1988 (CANB); 16 km E of Ongerup, *Newbey* 4610, 25.xi.1974 (PERTH).

Acknowledgements

The conservation coding for all taxa was determined during consultation with John Briggs. We thank Emile Brunoro, David Colman and Julie Faulkner for assistance with macrophotography. Scanning electron microscopy was carried out in the facility of the Division of Entomology, CSIRO. Advice on the latin diagnoses was provided by Ms Jane Bellemore (ANU). The Directors of AD, BRI, CANB, MEL, NSW and PERTH kindly made specimens available for study. Support of the Australian Biological Resources Study is gratefully acknowledged.

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Three new species of *Euphorbia* L. subgenus *Chamaesyce* Rafinesque (Euphorbiaceae) from central and northern Australia

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Abstract

Thomson, B.G. Three new species of *Euphorbia* L. subgenus *Chamaesyce* Rafinesque (Euphorbiaceae) from central and northern Australia. Nuytsia 8(3): 351-360 (1992). *Euphorbia centralis* from central Australia, *E. maconochieana* from the Victoria River and *E. kimberleyensis* from the northern Kimberley region are described, illustrated and their affinities with related species discussed. *E. vaccaria* Baillon is lectotypified.

Introduction

Euphorbia L. is a worldwide genus of primarily sub-tropical and temperate distribution. It contains approximately 2000 species (Willis 1966) and is represented in Australia by an estimated 45 species.

Bentham (1873) included 18 species in his revision of the genus. These he treated in 2 sections; *Eremophila* Boiss. with 1 species and *Anisophyllum* (the correct author being Roeser rather than Roxborough as stated) with 17. Bentham later transferred the single species that he had placed in section *Eremophila* to section *Eremophyton* Boiss. (Bentham & Hooker 1880). This section has since been given sub-generic status by Wheeler (1943) and now includes five Australian species (Hassall 1977).

Section *Anisophyllum* had also been given sub-generic status (Gaucher 1898), however, the name at this level of classification was preoccupied. The name correctly applied at sub-generic rank to this taxon is *Chamaesyce* Rafinesque 1817 (Croizat 1938, Wheeler 1943).

In 1821 S.F. Gray elevated *Chamaesyce* to generic status in 'A Natural Arrangement of British Plants'. Since this time many researchers have supported its retention at this level (Croizat 1938, Webster 1975) and many have rejected it (Wheeler 1941, Radcliffe-Smith 1975). Hassall (1976) appraised the situation as it related to Australian species and supported the retention of *Chamaesyce* as a distinct genus. This change was not, however, widely accepted as evidenced by the treatments of Euphorbiaceae in many subsequent state and regional floras.

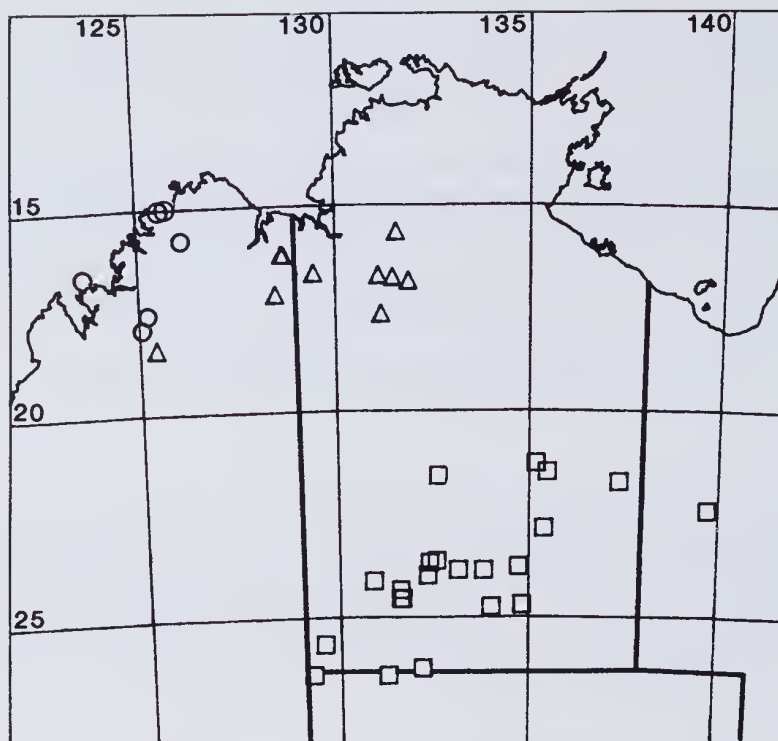


Figure 1. Distribution of *Euphorbia centralis* (□), *E. maconochieana* (Δ), and *E. kimberleyensis* (○).

Most authors agree that the taxon *Chamaesyce* is a natural one. The difficulties arise, however, in concisely defining the group. As Wheeler (1941) points out, it is with the greatest difficulty that *Chamaesyce* can be defined so as to exclude all members of other taxa and, at the same time, include all members of *Chamaesyce*. Although this statement was applied by Wheeler to the characters detailed by Croizat (1938) and earlier authors, it can be just as readily applied to the more modern arguments citing carbon fixation pathways (Webster *et al.* 1975) and cytological evidence (Hassall 1976).

A most important feature that serves to define *Chamaesyce* is the unique growth habit whereby the main stem axis aborts its apical meristem just above the first pair of true leaves. All subsequent growth arises sympoidally from the region of the cotylendnary nodes (Croizat 1938). This character is clearly seen in many of the prostrate species. Many, however produce only a single, erect stem and, in these cases, the interruption of the primary axis becomes particularly difficult if not impossible to observe in the mature plant. Croizat (1938) illustrates this feature. Thus, while the character is diagnostic of *Chamaesyce*, it is not particularly helpful in terms of practical taxonomy.

In this study and in future work, including the preparation of the treatment for the Flora of Australia, I follow Wheeler (1941) in accepting *Chamaesyce* at a sub-generic level.

The species dealt with below, are members of sub-genus *Chamaesyce* Rafinesque and are the first of a number of new taxa that have been revealed as a result of studies undertaken to provide an account for the Flora of Australia.

Descriptions and lectotypification

1. *Euphorbia centralis* B.G. Thomson, sp. nov. (Figure 2)

E. australis Boissier affinis, ab qua foliis late ovatis vel orbiculatus, serratis, appendicis glandis distincte laciniata, suffruticoso habitu distinguenda.

Typus: 3 km SW of Alice Springs, Northern Territory, 23° 35' S, 133° 50' E, 18 January 1990, B.G. Thomson 3408 (holo: DNA; iso: AD, BRI, CANB)

Erect or occasionally decumbent annual or perennial *sub-shrub* to 30 cm tall, multi-stemmed from the base. *Stems* puberulous to pilose with hairs 0.2–1 mm long. *Stipules* triangular, 0.2–0.4 mm long, margins lacerate and with ciliate hairs. *Leaf lamina* broad-ovate to orbicular, 3–5.5 x 1.5–5 mm, surfaces puberulous to pilose, margins serrate in the upper half, base oblique, apex obtuse. *Petioles* 0.5–1.3 mm long. *Inflorescence* in form of cyathia, solitary, axillary, throughout the plant or in upper parts only. *Cyathia* turbinate, 0.8–1.1 x 0.8–1.1 mm, puberulous to hispid. *Cyathial lobes* triangular, margins ciliate with stiff, white hairs. *Glands* oblong, concave, 0.2–0.4 x 0.1–0.3 mm. *Gland appendages* 0.6–1.3 x 0.3–0.5 mm, light green, cream, pink or red, margins strongly laciniate. *Androphores* level with the cyathial rim or exserted. *Gynophore* glabrous or pubescent, 1.3–2 mm long. *Capsule* 1.5–2 x 1.8–2.2 mm, muricate to hispid. *Styles* 0.3–0.4 mm long, glabrous. *Seeds* narrowly ovoid, 0.9–1.5 x 0.5–0.6 mm, tetragonous to tetraquetrous, rugose, brown (or mottled creamy brown with mucilage coat intact).

Selected Specimens. NORTHERN TERRITORY: James Range, 3 km N of Hugh River, A.C. Beauglehole 24586 (CANB, DNA); Hatchers Creek Mine, 20° 55' S, 135° 12' E, D.V. McKey 302 (DNA); 7 miles NNE of Willowra Homestead, 21° 15' S 132° 37' E, P.K. Latz 1245 (DNA); 'Victory Downs' Station, 25° 59' S 132° 10' E, P.K. Latz 5099 (BRI, DNA); 22 miles SSW of Georgina Downs Station, 21° 22' S, 137° 24' E, R.A. Perry 3471 (CANB, DNA); 5 km WNW of Supplejack Bore, 'Elkedra' Station, 21° 10' S, 135° 30' E (DNA); 6 km E of John Hayes Rockhole, Trepchina National Park, 23° 31' S, 134° 22' E, B.G. Thomson 1496 (DNA); 1 km S of Muranji Rockhole, Mt Winter, 23° 49' S, 130° 53' E, B.G. Thomson 1552 (AD, DNA, NT); eastern end of Harts Range, 23° 03' S, 134° 39' E, B.G. Thomson 2413 (DNA, MEL, NT); Mt Zeil, 23° 24' S, 132° 23' E, B.G. Thomson 2737 (DNA).

SOUTH AUSTRALIA: Musgrave Range, 1 mile E of Mt Woodroffe, R. Hill & T.R.N. Lothian 712 (AD, DNA); Kalka, Tomkinson Ranges, 26° 07' S, 129° 10' E, A. Kalotas 831 (DNA).

QUEENSLAND: 3 miles NW of 'Buckingham Downs' Station, M. Lazarides 4345, (CANB, DNA).

Distribution. *E. centralis* occurs from the Tennant Creek region (NT) to the Musgrave Ranges (SA) and from Mt Isa (Qld), west to the Docker River region (NT). (Figure 1)

Habitat. Found commonly on limestone, quartzite and sandstone ranges and low hills.

Affinities. This species is closely allied to *E. australis* Boissier but differs in having strongly lacinate gland appendages and more orbicular, deeply serrate leaves. Mature plants exhibit a rounded, shrub-like habit, the lower leaves withering but often persisting on the stems.

Conservation status. *E. centralis* is common and well represented in collections from central Australia and can not be considered as rare or endangered.

Etymology. The specific epithet relates to the species' central Australian distribution.

2. *Euphorbia vaccaria* Boiss., *Adansonia* 6: 286 (1866). *Type citation*: 'Exs. F. Mueller, Victoria River (herb.). - *Id.* "Rocky high hills Hierson island, Nickol bay." *Lectotype* (here chosen): Nickol [Nichol] Bay, P. Walcott (MEL 1551017).

Typification. Baillon (1866) described *Euphorbia vaccaria* and cited material collected by Mueller from the Victoria River and by an unknown collector from Rocky High Hills, Heirson (Hearson) Island, Nickol (Nichol) Bay. In the course of this study, three specimens collected by Mueller from the Victoria River and named by him as *E. vaccaria* were examined. These specimens were located in MEL (MEL 1551016, 1551015, 1551018). Also located in MEL was the Heirson (Hearson) Island specimen bearing an original, hand-written label including the details cited by Baillon and the collector's initials. A comparison of handwriting confirmed that this specimen was one collected by Pemberton Walcott who visited Nickol (Nichol) Bay with the F.T. Gregory Expedition from May to July 1861. According to Baillon, who worked in Paris, these specimens were received on loan from Mueller. A search in Paris failed to locate any further material.

On close inspection of these syntypes it was apparent that they represented two separate taxa, the material collected by Mueller being quite different from Walcott's specimen. Baillon's protologue describes *E. vaccaria* as villous and, in this respect his description matches Walcott's specimen but is at odds with the Mueller collections. Mueller's specimens have a short, puberulous indumentum which is only visible under magnification. In no way could they be considered as villous even allowing for the broadest interpretation of the term.

Although the Walcott specimen is cited in the protologue without the collector's name, Baillon has included sufficient details to reliably establish it as a syntype. The same, however, can not be said for the Mueller material. Although the three specimens examined were collected from the Victoria River and bear label data that agree with the protologue, it is not clear which of these specimens were seen by Baillon. Baillon apparently did not annotate any of the material that he examined on loan from Mueller.

In consideration of the above points, I have chosen the Walcott specimen (MEL 1551017) as the lectotype for *E. vaccaria*. The Mueller material represents a new species described below as *E. maconochieana*.

3. *Euphorbia maconochieana* B.G. Thomson sp. nov. (Figure 3)

E. schultzie Benth. affinis, ab qua appendicis glandis petaloidea grandi, aba, integra, capsula parviore, marginibus folii integris distinguenda.

Typus: Cahills Crossing; Victoria River crossing on the Top Springs to 'Victoria River Downs' road, N.T., 16° 20' S, 131° 07' E, B.G. Thomson 3486 (holo: DNA; iso: AD, BRI, PERTH).

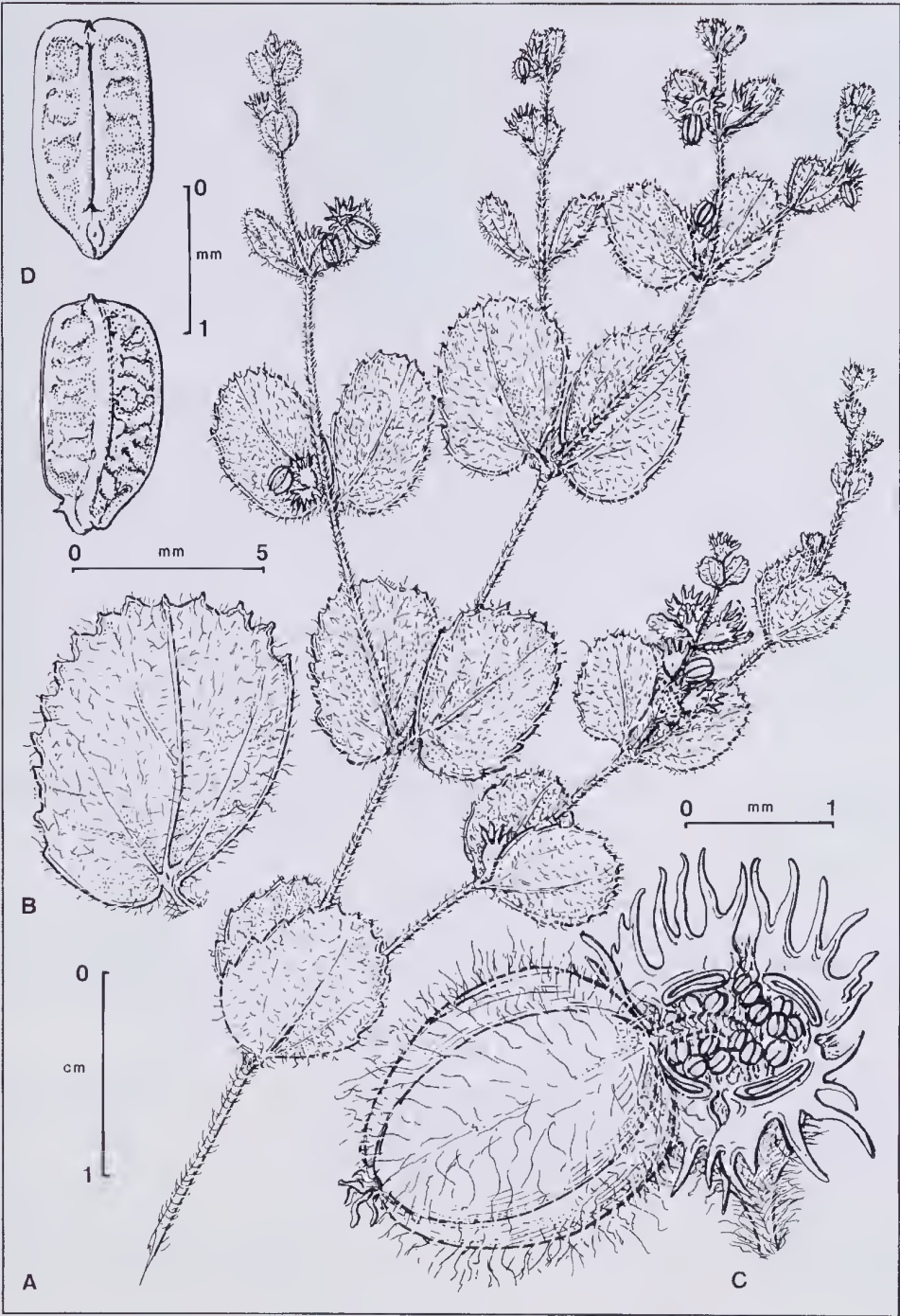


Figure 2. *Euphorbia centralis* A - habit, B - leaf, C - cyathia and capsule, D - seed. From B.G. Thomson 3408.

Prostrate, annual *herb*. *Stems* puberulous with curved or occasionally straight hairs to 0.2 mm long. *Stipules* subulate, 0.2-0.5 mm long, often divided into several filiform segments, margins ciliate. *Leaf lamina* elliptic to obovate, 6-15 x 2-7 mm, upper surface glabrous to puberulous, lower surface puberulous, margins entire, base strongly oblique, apex obtuse. *Petioles* 0.5-1 mm long. *Inflorescence* in form of cyathia, solitary, axillary, throughout the plant or occasionally in upper parts only. *Cyathia* turbinate, 1.3-1.9 x 1.2-1.7 mm, densely muricate, puberulous. *Cyathial lobes* triangular, margins ciliate with stiff, white hairs. *Glands* oblong, flat to concave, 0.3-0.5 x 0.3-0.4 mm, pink to dark red. *Gland appendages* 0.1-0.5 x 0.3-0.9 mm, white, prominent on living material, margins entire. *Androphores* exerted above the rim of the cyathia. *Gynophore* scabrous 1.0-1.6 mm. *Capsule* 1.7-2.1 x 1.9-2.2 mm, densely muricate and often puberulous with short, stout hairs. *Styles* 0.3-0.5 mm long, smooth or minutely scabrous. *Seeds* ovoid, 1.1-1.4 x 0.7-0.8 mm, tetragonous, lightly rugose, light brown (or creamy brown with mucilage coat intact).

Specimens examined. NORTHERN TERRITORY: 51 miles E of 'Victoria River Downs', 16° 23' S, 131° 29' E, *G. Chippendale* 6095 (DNA); 10 miles NNE of 'Wavehill' Station, 17° 17' S, 131° 10' E, *M. Lazarides* 6278 (DNA); Victoria River Crossing on Top Springs/Timber Creek Road, 16° 20' S, 131° 06' E, *M.O. Parker* 1009 (DNA); 4 miles S of 'Willeroo' outstation, 15° 19' S, 131° 35' E, *R.A. Perry & M. Lazarides* 2025 (DNA); 46 miles SW of 'Birrimbah' Outstation, 16° 30' S, 131° 52' E, *R.A. Perry & M. Lazarides* 2078 (DNA); 4 km S of No. 10 Bore, Rosewood Station, 16° 16' S, 129° 27' E, *B.W. Strong* 989 (DNA); Victoria River, *F. Mueller s.n.* (MEL 1551015, 1551016, 1551018).

WESTERN AUSTRALIA: near Oscar Range road to Leopold N, *A.J. Ewart s.n.* (PERTH); Drain 7, Paeksaddle Creek, Kimberley, 15° 49' S, 128° 41' E, *K.F. Kenneally* 1941 (PERTH); Kunnunurra, *E.M. Scrymgeour* 1673 (PERTH); Smoke Creek, SW of Lake Argyle, 16° 45' S, 128° 30' E, *A.S. Weston* 12185 (PERTH).

Distribution. This species is known from the Victoria River region in the Northern Territory and adjacent Lake Argyle in Western Australia. (Figure 1)

Habitat. Normally found in heavily textured, alluvial soils.

Affinities. *E. maconochieana* is closely related to *E. schultzi* Benth. and shares an almost identical indumentum characterised by short (0.2 mm or less), thick, incurved hairs. It is separated from *E. schultzi* by the following key.

1. Gland appendages entire, white; capsules 1.7-2.1 mm long, 1.9-2.2 mm wide; leaf margins entire; prostrate annual *E. maconochieana*
1. Gland appendages denticulate, pink to red; capsules 2.3-2.8 mm long, 3.0-3.5 mm wide; leaf margins serrate; erect, decumbent or prostrate annual or occasionally perennial *E. schultzi*

Conservation status. This species, although rather poorly collected, is not considered as rare or endangered in any part of its range.

Etymology. The species is named in honour of the late Mr J.R. Maconochie, a close friend and former colleague at the Northern Territory Herbarium.

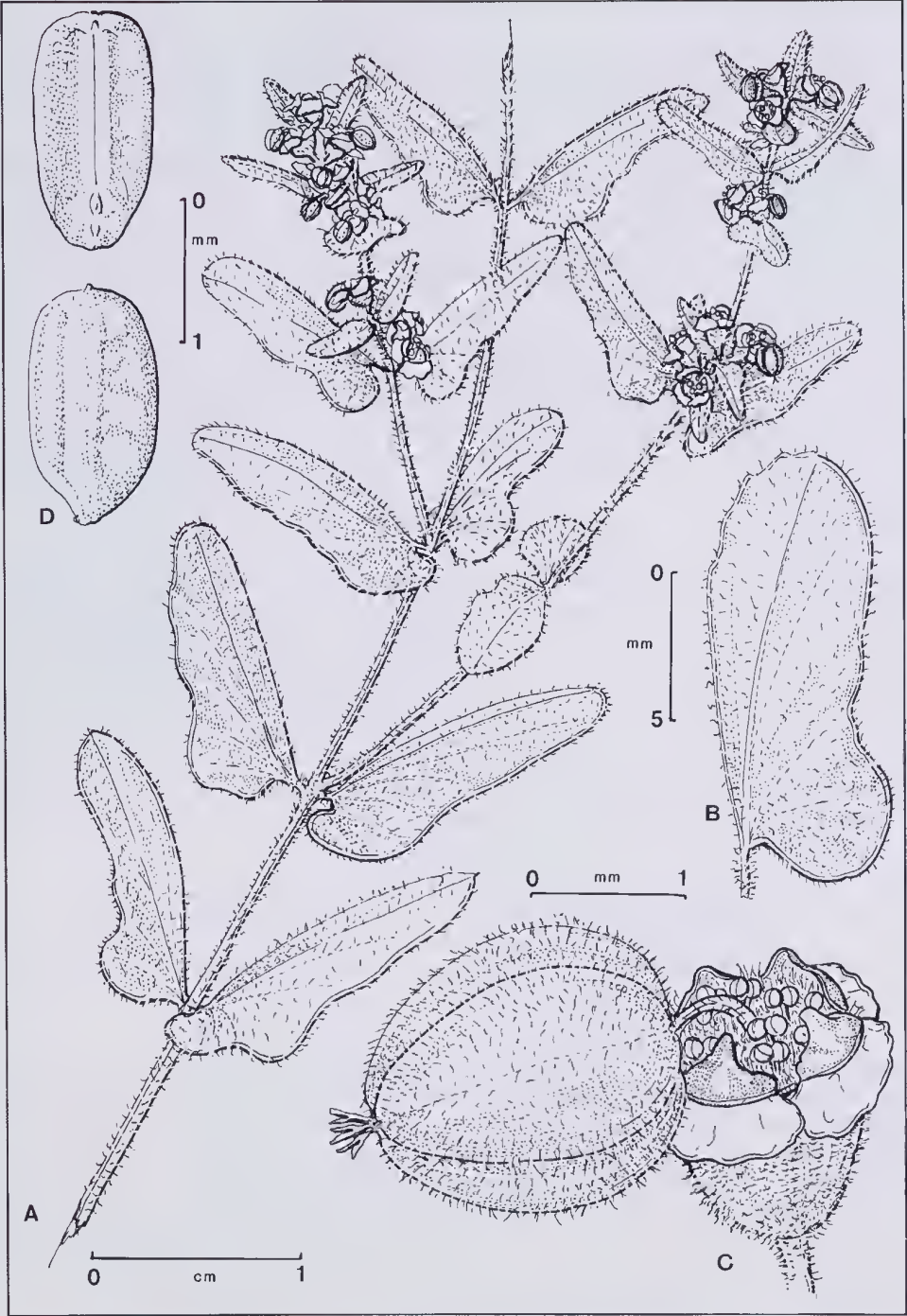


Figure 3. *Euphorbia maconochieana* A - habit, B - leaf, C - cyathia and capsule, D - seed. From B.G. Thomson 3486.

4. *Euphorbia kimberleyensis* B.G. Thomson sp. nov. (Figure 4)

E. schizolepis F. Muell. ex Boiss. affinis, ab qua caulibus et foliis glabris vel glabratibus, capsula et semine parvioribus et stylo glabro distinguenda.

Typus: Palm Woodland, Mitchell Plateau, West Kimberley, 14° 50' S, 125° 50' E, 15 June 1976, K.F. Kenneally 4921 (holo: PERTH; iso: CANB)

Annual herb, prostrate or with ascending or decumbent stems, to 20 cm tall. Stems glabrous or puberulous. Stipules subulate, 0.2-0.5 mm long, margins lacerate. Leaf lamina elliptic to obovate, 6-16 x 5-12 mm, surfaces glabrous, margins entire, base oblique, apex apiculate, often earinate. Petioles 1-2 mm long. Inflorescence in form of cyathia, solitary, axillary, throughout the plant or in clusters of 2-4 on lateral brachlets due to shortening of internodes. Cyathia turbinate, 1.5-2.0 x 1.2-1.5 mm, glabrous. Cyathial lobes narrow-triangular, margins conspicuously fimbriate. Glands orbicular to oblong, flat or concave, 0.6-1.1 x 0.4-0.7 mm, red. Gland appendages 0.5-2.0 x 0.8-2.0 mm, white or pink, margins denticulate. Gynophore 3.0-4.5 mm long, glabrous. Capsule 3.2-3.7 x 3.0-3.5 mm, smooth or tuberculate, glabrous or rarely with sparse pubescence. Seeds ovoid, tetragonal, 1.9-2.3 x 1.2-1.4 mm, rugose with flat topped ridges, cream to brown.

Specimens examined. WESTERN AUSTRALIA: Near Lone Dingo VT, 9 km SW of Warrender Hill, 14° 30' S, 125° 45' E, J.J. Alford 551 (PERTH); Kalumburu Road, 108.9 km by road N of Gibb River and Ellenbrae Road, 15° 23' S, 126° 12' E, Aplin *et al.* 721 (PERTH); base of Mt Behn, West Kimberley, W.V. Fitzgerald 685 (PERTH); Inglis Gap, King Leopold Range, W.V. Fitzgerald 755 (PERTH); 1.6 km along Surveyors Fall Track, N of Mitchell Plateau Mining Camp, N Kimberley, 14° 40' S, 125° 47' E, A.S. George 14478 (PERTH); Port Warrender, Mitchell Plateau, W Kimberley, 14° 34' S, 125° 16' E, K.F. Kenneally 5254 (PERTH); area of Carson Volcanics towards Port Warrender, off the laterite plateau, W Kimberley, 14° 34' S, 125° 50' E, K.F. Kenneally 6704 (PERTH); Crocodile Creek, 5 km E of west end of Koolan Island, W Kimberley, 16° 10' S, 123° 41' E, K.F. Kenneally 9719 (PERTH).

Distribution. From Derby, north-east to the Drysdale River, Western Australia. (Figure 1)

Habitat. Found commonly in association with open woodland communities on lateritic red soil or sandstone.

Affinities. This species is closely related to *E. schizolepis* F. Muell ex Boiss. and, in particular to *E. schizolepis* var. *glabra* Benth. Benth. bases his variety on material collected by Mueller in the Gulf of Carpentaria and describes it as perfectly glabrous with the gland appendages much less lobed. A search in K failed to locate any material of Benth. 's variety. I have, however, examined a specimen in MEL which matches the protologue and is probably part of the type collection. This material is clearly not referable to *E. kimberleyensis*, differing in its larger cyathium and glaucous upper stems which are commonly seen on the more glabrescent forms of *E. schizolepis*. *E. kimberleyensis* is also restricted to the far north of Western Australia and does not occur in the 'Gulf of Carpentaria' which is the rather generalised collection locality given by Benth. for his variety *glabra*.

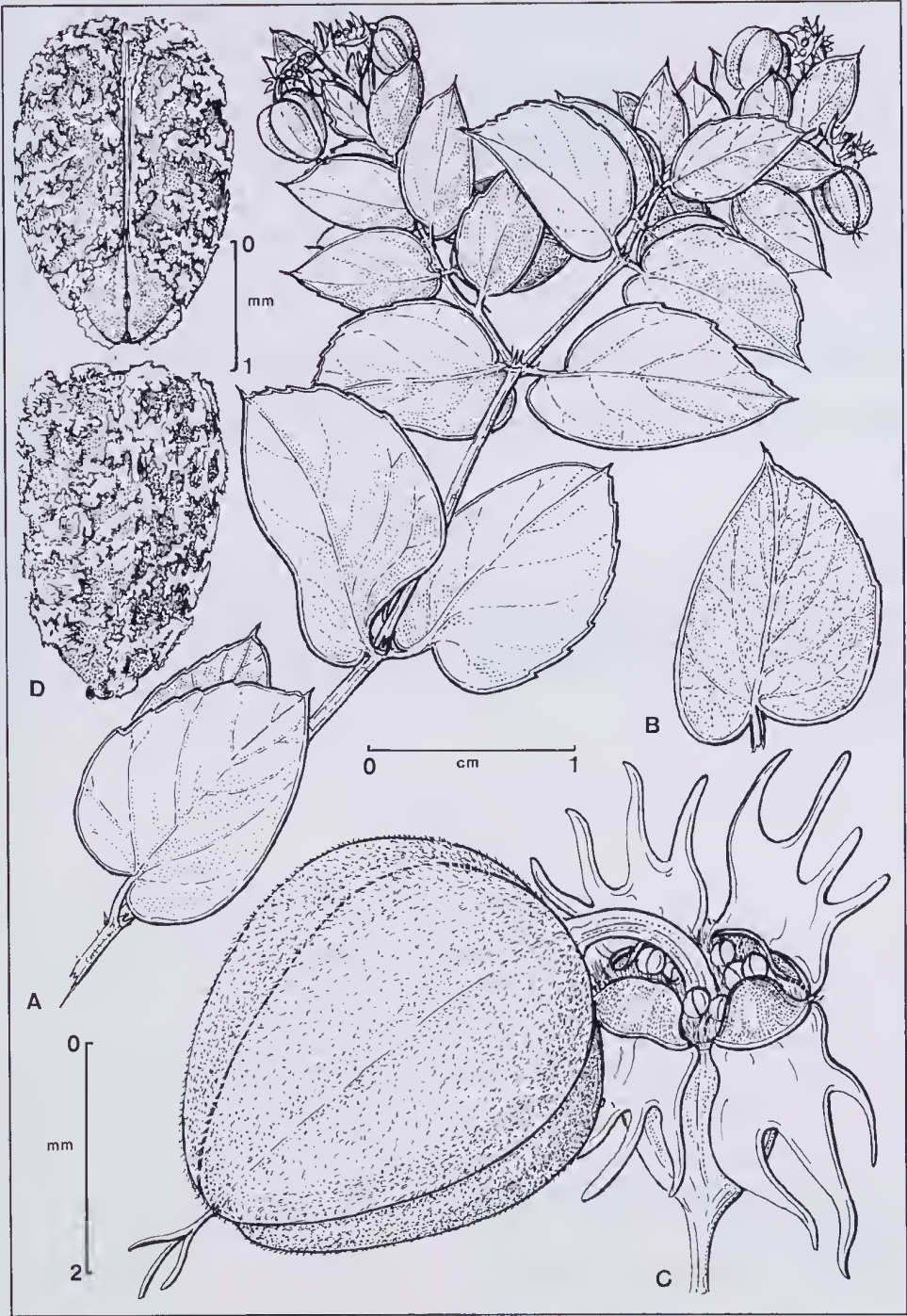


Figure 4. *Euphorbia kimberleyensis* A - habit, B - leaf, C - cyathia and capsule, D - seed. From K.F. Kenneally 4921

E. kimberleyensis may be distinguished from *E. schizolepis* by the following key.

1. Herbaceous, prostrate or weakly ascending annual, glabrous or occasionally with puberulous stems; capsules 3.2-3.7 mm long and 3.0-3.5 mm wide, smooth or tuberculate, glabrous or rarely with sparse pubescence; styles glabrous; seeds 1.9-2.3 mm long *E. kimberleyensis*
1. Erect annual or perennial, pilose to villous, rarely glabrescent; capsules 4.0-6.0 mm long and 4.5-6.5 mm wide, surface obscured by densely tomentose indumentum; styles distinctly pubescent; seeds 2.7-3.5 mm long *E. schizolepis*

Conservation status. This species appears to be common throughout its limited range.

Etymology. The specific epithet relates to the species distribution within the Kimberley region.

Acknowledgements

I would like to thank G. Leach and C. Dunlop for their critical review of the manuscript and assistance with the latin diagnoses. K.L. Wilson, as Australian Botanical Liaison Officer, searched collections held at K and P and also provided advice regarding overseas collections. I also wish to thank the Curator of the W.A. Herbarium (PERTH) for access to the collection. The drawings were prepared by Milton Andrews.

These species were examined in the field during a collecting trip to N.W. Western Australia which was made possible through Australian Biological Resources Study funding.

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The *Lawrencella* complex (Asteraceae: Gnaphalieae: Angianthinae) of Australia

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Abstract

Wilson, Paul G. The *Lawrencella* complex (Asteraceae: Gnaphalieae: Angianthinae) of Australia. Nuytsia 8(3): 361-377 (1992). The *Lawrencella* complex includes the monotypic genera *Bellida* and *Schoenia*, several species included by Bentham in *Helichrysum* sect. *Lawrencella*, and one species previously placed in both *Helichrysum* and *Podolepis*. It is considered to be a natural group clearly distinct from other members of the Angianthinae. Three genera are here recognised: *Bellida*, *Lawrencella*, and *Schoenia*. One subspecies is described as new; four new species combinations are made.

Introduction

For many years botanists have recognised that the Australian species placed in *Helichrysum* are not congeneric with the South African and European taxa of that genus (e.g. Merxmüller *et al.* 1977; Hilliard & Burtt, 1981), they have further recognised that the genus as circumscribed in Australia is an artificial assemblage of species and that the closest affinities of these species is frequently to species in other genera rather than to those within the genus (see Haegi 1986). Recently Anderberg (1991) has reviewed the tribe Gnaphalieae. He has removed the Australian species that had previously been included in *Helichrysum* and placed them in *Chrysocephalum* Walp., *Bracteantha* A. Anderb. & L. Haegi, *Ozothamnus* R.Br., *Schoenia* Steetz, and the '*Lawrencella*' complex which, he noted, required further study. The genus *Bellida* he treated as a distinct monotypic taxon possibly related to the *Waitzia* group.

A collaborative comprehensive classification of the *Helichrysum*-*Helipterum* complex in Australia is in preparation. Prior to this treatment a number of segregate genera are being described or recognised in preparation for a treatment of the family Asteraceae in volume 38 of the Flora of Australia. In view of this forthcoming publication, and in order to save time and avoid repetition, for some of the taxa investigated only brief descriptive details are provided.

For a long time some or all of the species that are here included in the *Lawrencella* complex have been considered to be related. The complex was recognised by Bentham (1867) as a section of *Helichrysum*, with the exclusion of *Schoenia* since its single species he considered to be generically

distinct due to its flattened achenes; he noted, however, that this species was otherwise similar to species in *Helichrysum* sect. *Lawrencella*. Mueller (1889) recognised the relationship between the one species of *Schoenia* and the species included by Bentham in sect. *Lawrencella* for he listed them together as species of *Helichrysum*, as did Black (1929, 1957). Earlier Black (1915) had suggested that if *Schoenia* is to be recognised as a genus distinct from *Helichrysum* then *H. ayersii* F. Muell. must be included in it. Haegi (1986) placed *Schoenia cassiniana* (as *Helichrysum cassinianum*), *Helichrysum ayersii*, *H. davenportii* F. Muell., and *H. semifertile* F. Muell. in sect. *Lawrencella* but noted that this section should have generic rank since the included species were very distinct from other members of *Helichrysum*. In a recent paper Anderberg (1991) indicated the close affinity between *Lawrencella* and *Schoenia* and recognised that further work was required before the status of related taxa could be clarified. In the '*Lawrencella*' complex he placed *Helichrysum ayersii*, *H. davenportii*, *H. lindleyi* Eichler (= *Lawrencella rosea* Lindley), *H. filifolium* (with its close relatives here referred to as the '*Xanthochrysum*' group), *H. spiceri* F. Muell. and *H. obtusifolium* F. Muell. & Sonder. I concur with his suggestions except that I exclude the last two species which I consider to generically distinct.

Tribal classification

The species included in the *Lawrencella* complex have traditionally been placed in the tribe Inuleae. Work on the tribal classification by Anderberg (1989) has indicated that this tribe should be divided into three, the Inuleae, the Gnaphalieae, and the Plucheae. The Gnaphalieae, as defined by Anderberg, comprises the taxa that were included in the two subtribes Gnaphaliinae and Athrixiinae by Merxmüller *et al.* (1977). In a recent comprehensive treatment of the tribe Gnaphalieae Anderberg (1991) has recognised a number of subtribes including the subtribe Angianthinae Benth. in which *Lawrencella* and its relatives are placed. Anderberg expressed uncertainty as to the systematic position of *Bellida* but, as indicated above, I consider that it should be included in the Angianthinae and that it is closely related to *Lawrencella*.

Taxonomy

The *Lawrencella* complex

Many of the characters that have been examined and used to delimit the genera have been discussed elsewhere (Wilson 1989). There are many morphological and anatomical characters associated with the plants that are of value in determining relationships, however, not all of these characters can be so described that they are readily comprehended. Thus the texture of the corolla, the shape of its constituent cells and the thickening of the cell walls are characters that are of value in suggesting affinity, though sometimes of limited use in formal descriptions because of their cryptic nature. I have expanded below on some of the characters that I consider to be important when assessing affinities.

A number of characters that are found in the achene are useful in serving either to distinguish the *Lawrencella* complex from other taxa that have been included in *Helichrysum*, or to distinguish the putative genera or infrageneric taxa within the group. Those characters that are used in this paper are as follows:

Testa: vascular strand (Figures 2-7). The testa always has a solitary vascular strand that may terminate before the apex of the seed proper, or may terminate at the apex of the seed (particularly in those cases where the apex is in the form of a short sterile apiculum), or may continue around the seed. This character appears to be constant in many sections or genera of the Australian Angianthinae as recently recognised. Thus in the *Helipterum albicans* group (*Leucochrysum* Paul G. Wilson, 1992b) the vascular strand consistently terminates in the short sterile apex of the seed. In *Bracteantha* it passes over the apex to the other side; while in *Waitzia* Wendl., *Chrysocephalum*, *Leptorhynchus* Less., and in the *Helichrysum elatum* group it ceases before reaching the apex. With regard to those taxa here referred to the *Lawrencella* complex it terminates in a sterile apex in *Bellida*, *Helichrysum davenportii*, and *Lawrencella rosea*, while it passes over the apex to the other side in *H. ayersii*, *Schoenia cassiniana*, and in species of the '*Xanthochrysum*' group.

Testa: epidermis. Examination of the cells of the outer layer of the testa in numerous species previously included in *Helipterum* and *Helichrysum* has shown that they in general have the same shape in species that are now recognised as being closely related but may vary in shape between species-groups and between genera. Thus in *Chrysocephalum s.str.* the cells are linear, in *Bracteantha* they are almost square with straight margins, while in *Waitzia* and *Leucochrysum* they are short-oblong with corrugate margins. In the *Lawrencella* complex they are \pm equilateral in all taxa except for *H. davenportii* and *Bellida* where they are short-oblong (Figures 2-7).

Corolla. The shape and texture of the tube and lobes, the indumentum, the shape and thickening of the cells of the inner epidermis, the papillosity of the inside of the lobes and throat, and the extent of the vasculature, are all characters that must be assessed for their generic significance. In the *Lawrencella* complex the corolla is regular with cylindrical tube and campanulate limb, the cells of the inner epidermis of the lobes are \pm equilateral and of the throat \pm straight, the vascular strands reach to the apex of the lobes, while the hairs on corolla tube are biseriate and gland-tipped. In *Bracteantha*, *Chrysocephalum*, *Ozothamnus*, and in the *Helichrysum obtusifolium* group the corolla is narrow-cylindrical and almost glabrous with vascular strands of the last three taxa not passing into the lobes.

Anthers (Figure 1). Of significance in the anther are the shape and length of the collar; the length, texture and branching of the tails; the shape and texture of the anther appendage, and the arrangement, shape, and thickening of its constituent cells. The shape of the anther appendage has frequently been noted but the constituent cells offer further characters that are of value when assessing affinities.

In the *Lawrencella* complex the appendage is acutely cordate or broad-ovate, the proximal cells \pm equilateral with thick walls, the distal cells oblong with thinner walls, and the marginal cells small and equilateral, the collar is narrow-oblong and the anther tails very weak and filamentous and extending beyond collar. This situation is similar to that found in *Rhodanthe* Lindley *s.l.* and contrasts with the other genera that have been traditionally included in *Helichrysum*; in these other genera (e.g. *Bracteantha*, *Chrysocephalum*, and *Ozothamnus*) the proximal cells of the appendage are the same as the distal and the tails are firm with the cell walls somewhat thickened.

Style (Figure 1). Of significance are the length and thickness of the arms, the shape and degree of papillosity of the apex, and the thickness and extent of the vascular strand. In the *Lawrencella* complex the arms are long, the apex deltoid with a stout vascular strand extending to its tip. This contrasts with the other taxa of Australian '*Helichrysum*' in which the apex is rounded, truncate, or acuminate, and of the same width as, or only slightly wider than, the style arm.

Pappus (Figures 2-7). In the *Lawrencella* complex the bristles are linear, firm, prominently barbellate, without spreading basal cilia, they are persistent or shed entire. In *Bellida*, *H. lindleyi* and *H. davenportii* the pappus lengthens during anthesis. In other members of '*Helichrysum*' the bristles are filiform or, if broadened at base, eventually break just above the base to leave a persistent corona on the achene.

Achene apex (Figures 2-7). The apex of the achene forms a shallow rim around the base of the pappus in *Helichrysum cassinianum* and in *H. ayersii*, in the other species of the *Lawrencella* complex the achene apex narrows and passes smoothly into the pappus base.

Achenial hairs (Figures 2-7). Normal duplex hairs, when present, are thick-walled; two-celled papillose hairs are absent. The pericarp is velutinous with minute acicular unicellular papillae in *Bellida*, *H. lindleyi*, and *H. davenportii*, in at least some of the achenes. In *H. davenportii* acicular multicellular hairs are sometimes also present. The achenes of *H. cassinianum*, *H. ayersii*, and the '*Xanthochrysum*' group lack these papillae or hairs but bear scattered multicellular gland-tipped hairs in addition to normal duplex hairs.

Vasculature of the achene and seed (Figures 2-7). The position of the two vascular strands in the pericarp in relation to the solitary vascular strand in the testa and to the position of the cotyledons of the embryo was suggested by Short *et al.* (1989) to be of generic significance.

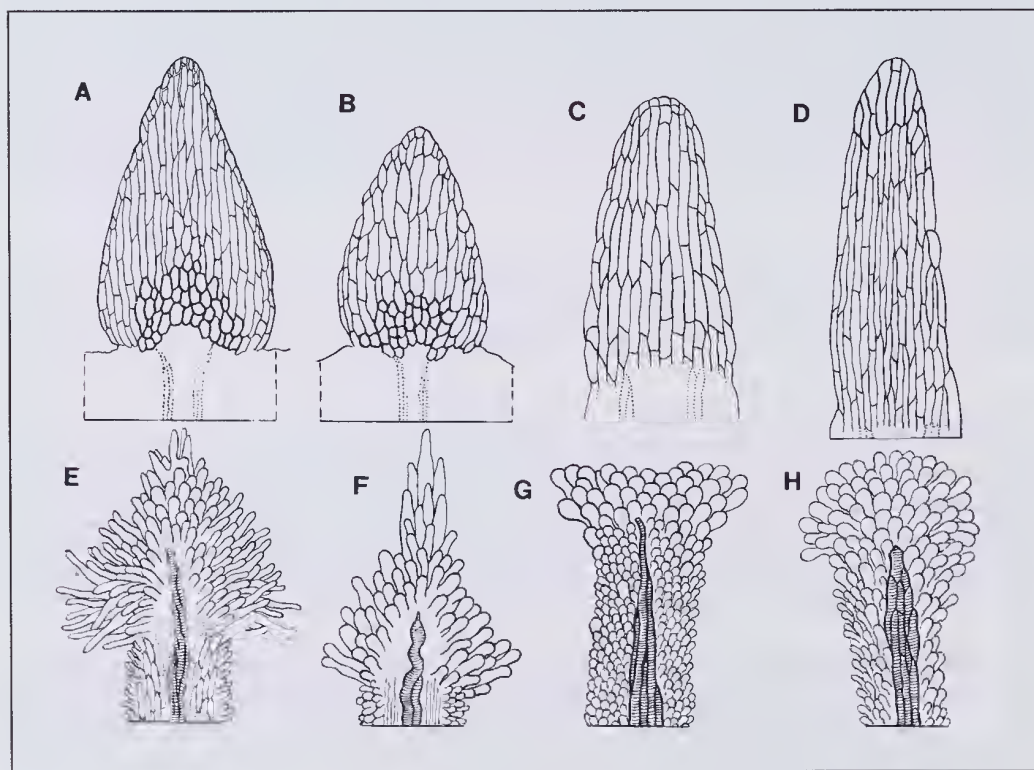


Figure 1. Anther apicula (A-D) and style apices (E-H) of *Lawrencella davenportii* (A & E), *Bellida graminea* (B & F), *Ozothamnus lepidophyllus* (C & G), and *Chrysocephalum semicalvum* (D & H).

The strands of the pericarp and testa are laterally placed (with regard to cotyledons) in *Bellida*, *Helichrysum lindleyi*, and *H. davenportii*, while in *H. cassinianum*, *H. ayersii*, and in the '*Xanthochrysum*' group they are medially placed.

Carpopodium. The carpopodium is small or insignificant in all species of the *Lawrencella* complex; however, in *Bellida*, *H. lindleyi*, and *H. davenportii* the achene has a prominent hollow base while in *H. cassinianum*, *H. ayersii*, and in the '*Xanthochrysum*' group the base is not excavated.

Receptacle. The receptacle is smooth and glabrous in all the taxa of the *Lawrencella* complex except for the '*Xanthochrysum*' group in which it is glandular papillose.

A summary of some of these characters for the taxa of the *Lawrencella* complex is listed in Table 1.

	B	L	D	C	A	X
Pericarp v.s.						
lateral	+	+	+			
medial				+	+	+
Testa v.s.						
to apex	+	+	+			
circum.				+	+	+
Achene base						
minute				+	+	+
excav.	+	+				
Achene apex						
rimmed				+	+	
not rimmed	+	+	+			+
Pericarp						
thick	+	+	+			
thin				+	+	+
velutinous	+	+	+			
not vel.				+	+	+
Gland. hairs						
present				+	+	+
absent	+	+	+			
Pappus						
elongating	+	+	+			
not elong.				+	+	+
Receptacle						
papillose						+
smooth	+	+	+	+	+	

Table 1. Comparison of some characters of the achene and capitulum in *Bellida* (B), *Helichrysum lindleyi* (L), *H. davenportii* (D), *H. cassinianum* (C), *H. ayersii* (A), and the '*Xanthochrysum*' group (X).

Chemical data

Few Australian species of *Helichrysum* have been chemically investigated and the taxonomic significance of the results of those that have is not very informative. However, in a paper by Jakupovic *et al.* (1989) the results of an analysis of *Helichrysum davenportii*, *H. lindleyi*, and *Bellida graminea* were presented along with analyses of *H. ambiguum* Turcz. (= *Chrysocephalum*), *H. bilobum* Wakef. (= *Ozothamnus*), and *H. leucopsideum* DC. From this investigation some tentative conclusions were drawn.

In *Helichrysum davenportii* was found isokaurenic acid and a thiophene derivative numbered 37. In *H. lindleyi* the thiophenes numbered 37 and 38 and some triterpenes were found, while in *Bellida graminea* were found thiophene acetylenes and the desoxy derivative of isokaurenic acid numbered 37a and the thiophene numbered 38. These compounds were not found in the three other species of Australian '*Helichrysum*'.

The chemical analyses therefore suggests that the three '*Lawrencella*' species are more closely related to each other than they are to the remaining '*Helichrysum*' species. This lends support to the opinion, based on morphological considerations, that the '*Lawrencella*' complex is a natural assemblage of taxa.

Mycorrhizal data

It has been demonstrated by Warcup (1990) that Australian species in the tribe Inuleae can be almost equally divided into those that form only vesicular-arbuscular mycorrhiza (VAM species) and those that form both ectomycorrhiza and vesicular-arbuscular mycorrhiza (Ecto species). The Australian taxa placed in '*Helichrysum*' can also be separated into Ecto and VAM species. The presence of both VAM and Ecto species in the same genus is unusual since normally genera have been found to contain species that are either all ectomycorrhizal or all non-ectomycorrhizal. When the '*Helichrysum*' species are segregated into those genera recognised by Anderberg (1991) and by myself the situation changes, for then each of the segregate genera contains, as far as is known, only ectomycorrhizal or only non-ectomycorrhizal species.

Warcup (1990) examined the mycorrhiza of the following species in the *Lawrencella* complex: *Helichrysum ayersii*, *H. cassinianum*, *H. lindleyi*, *H. davenportii*, *H. subulifolium*, and *Bellida graminea*; he found them all to be non-ectomycorrhizal. This is also the situation in *Rhodanthe s.l.* (Wilson 1992a) and *Helichrysum* subg. *Ozothamnus* (*Ozothamnus* R.Br.); it contrasts with the situation in the *Helichrysum bracteatum* group (*Bracteantha*), the *H. apiculatum* group (*Chrysocephalum*), and in the *H. leucopsideum* group all of which are ectomycorrhizal.

Generic circumscription

On the basis of the characters that are found in the achene (see above) a close relationship is suggested between *H. cassinianum*, *H. ayersii*, and the species of the '*Xanthochrysum*' group on the one hand, and between *Bellida*, *H. lindleyi* and *H. davenportii* on the other. This correlates with the nature of the pappus which in *H. lindleyi*, *H. davenportii*, and *Bellida* elongates during anthesis to extend beyond the corolla while in the other genera it remains more or less equal to the corolla.

The number of genera that should be recognised in the *Lawrencella* complex is difficult to assess, partly because of the few species involved and their morphological diversity (apart from those in the '*Xanthochrysum*' group). Of the taxa represented, *Bellida* appears to be morphologically distinct and I am continuing to recognise it as a monotypic genus. However, the morphology of the epidermal cells of its testa suggests that *Bellida* and *H. davenportii* are more closely related to each other than either is to *H. lindleyi*. With the exclusion of *Bellida* I am dividing the taxa into two genera based on characters observed in the achene and pappus. These two genera consist of 1) *Helichrysum lindleyi* and *H. davenportii*, and 2) *H. ayersii*, *H. cassinianum*, and species of the '*Xanthochrysum*' group.

Key to genera and species of the *Lawrencella* complex

1. Vascular strands of pericarp in lateral position in relation to cotyledons;
base of achene excavated
 2. Apex of achene extended to form a pair of cup-shaped protuberances;
ray bracts absent *Bellida*
 2. Apex of achene truncate; ray bracts present (*Lawrencella*)
 3. Leaves terete, cauline *Lawrencella lindleyi*
 3. Leaves flat, sub-basal *Lawrencella davenportii*
1. Vascular strands of pericarp in medial position in relation to cotyledons;
base of achene not excavated (*Schoenia*)
 4. Leaves flat (*Schoenia* subgroup)
 5. Ray bracts present, pink or white *Schoenia cassiniana*
 5. Ray bracts absent *Schoenia ayersii*
 4. Leaves terete (*Xanthochrysum* subgroup)
 6. Terminal barbs of pappus bristles densely clustered, clavate
 7. Involucre narrow-cylindrical or narrow-turbinate; lamina of
ray bracts 3-4 mm long; plant cottony *Schoenia ramosissima*
 7. Involucre hemispherical; plant shortly hirsute *Schoenia macivorii*
 6. Terminal barbs of pappus bristles distinct, acute *Schoenia filifolia*

Bellida Ewart, Proc. Roy. Soc. Victoria 19:34(1907).

Type: Bellida graminea Ewart

Annual erect herb to 12 cm high with several leafless scapes arising from base, glabrous except for white villi at base of stems. Leaves basal, filiform. Capitula solitary, terminal. Involucre turbinate, not radiant; bracts 3-seriate, hyaline with a narrow brown sterome reaching to apex, central nerve continuing as a piliferous tip. Receptacle hemispherical, glabrous. Florets numerous, actinomorphic, outer bisexual, inner male. Corolla: tube shortly cylindrical, pilose; limb barrel-shaped, glabrous; lobes 5, papillose within, sparsely pilose outside, vascular strands extending to apex, cells of inner epidermis \pm equilateral. Anthers: appendage narrow-cordate, proximal cells \pm equilateral and thick-walled, medial and distal cells oblong and thin-walled, marginal cells small; collar narrow-oblong; tails extremely fine and exceeding collar. Style apex deltoid, acute to acuminate, vascular strand stout, extending to apex. Achene compressed clavate, stipitate with

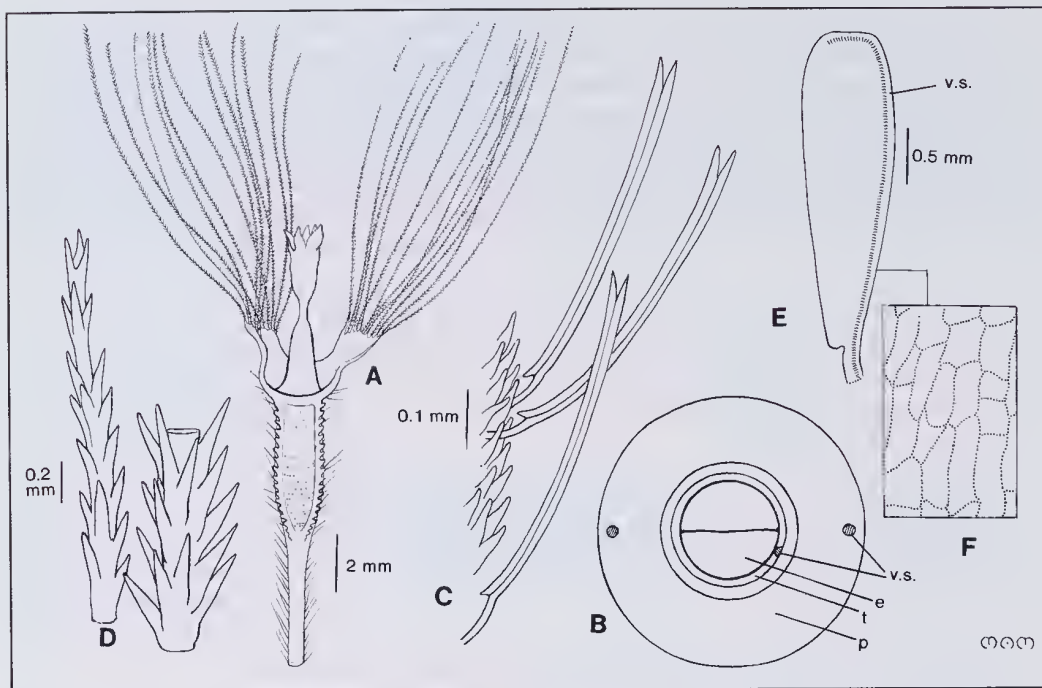


Figure 2. *Bellida graminea*. A - achene with pappus and corolla. B - T.S. achene (semidiagrammatic). C - achenial single celled papillae and duplex hairs. D - portion of pappus bristles. E - seed (i.e. testa). F - epidermal cells of testa. (v.s. - vascular strand, p - pericarp, t - testa, e - embryo.) From *Kings Park* 793/86.

excentric hollow base, moderately to sparsely hirsute with duplex hairs and densely and minutely velutinous with acute single-celled papillae (in smooth achenes these absent), not myxogenic, at apex expanded into two cup-shaped extensions that bear the pappus; pericarp deeply and transversely rugose (or occasionally smooth), thick and cartilaginous, a vascular strand in each margin of achene. Seed compressed turbinate, free from pericarp; testa thin, vascular strand extending to apex in medial position and at right-angles to vascular strands of pericarp. Pappus at anthesis about half as long as the corolla, in fruit almost twice as long; bristles filiform, prominently dentate, reddish towards apex, united into groups that are firmly fixed to each of the extensions of the achene, persistent.

A monotypic genus.

Bellidagraminea Ewart, Proc. Roy. Soc. Victoria 19:35(1907). *Type*: Jibberding, Western Australia, 1905, *M. Koch s.n.* (iso: PERTH). (Figures 1 & 2)

Distribution. Found only in southern Western Australia.

Moore (1917) indicated a relationship of *Bellida* to *Helichrysum davenportii* and treated them as being congeneric, while Anderberg (1989) has suggested that *Bellida* may not even be a member of the Gnaphalieae. I consider that the similarity of floral and fruit morphology between *Bellida* and *Lawrencella* indicate that its position here is correct. The similarity is strongest to *Lawrencella davenportii* which, if a true reflection of phylogeny, indicates that *Lawrencella* as treated here is paraphyletic.

Lawrencella Lindley, Sketch Veg. Swan R. Col. 23(1839).

Helichrysum sect. *Lawrencella* (Lindley) Benth., Fl. Austral. 3:613(1867). Type: *Lawrencella rosea* Lindley

Annual herbs, glandular puberulous or pilose. Stem single, erect, branched above. Leaves cauline or sub-basal, opposite or alternate, terete or flattened. Capitula terminal to branches or leafless seapes, radiant. Involucre hemispherical; bracts 3-6-seriate. Outer and intermediate bracts narrow-triangular to narrow-oblong, chartaceous, ciliate; sterile narrow-triangular, thin; innermost bracts: claw oblong, hyaline with an oblong flat sterile; lamina elliptic, pink. Receptacle cushion shaped, smooth, glabrous. Florets numerous, outer bisexual, inner male. Corolla actinomorphic, tubular below, narrowly campanulate above, glandular hispidulous; cells of throat with straight walls; lobes 5, papillose within, vascular strands extending to tip. Anther appendage broad-ovate; proximal cells equilateral, thick-walled, distal cells oblong, thin-walled, marginal cells small; collar narrow-oblong; anther tails filamentous exceeding collar. Style apex deltoid, vascular strand, extending to tip. Achenes polymorphic; base excavated forming a hollow extension of the pericarp, pericarp hard and thick, smooth or rugose, glabrous or velutinous with minute aciform 1-celled papillae or scabrous with flattened acuminate multicelled trichomes or sparsely hispid with stiff duplex hairs; seed narrow-fusiform with a short flattened sterile tip, free from pericarp; testa membranous, vascular strand laterally placed with reference to cotyledons, terminating in the flattened tip. Pappus persistent, colourless or pink, shorter than corolla at anthesis but lengthening in fruit; bristles firm, linear-acuminate, prominently dentate, united in groups towards base.

Two species endemic to Australia.

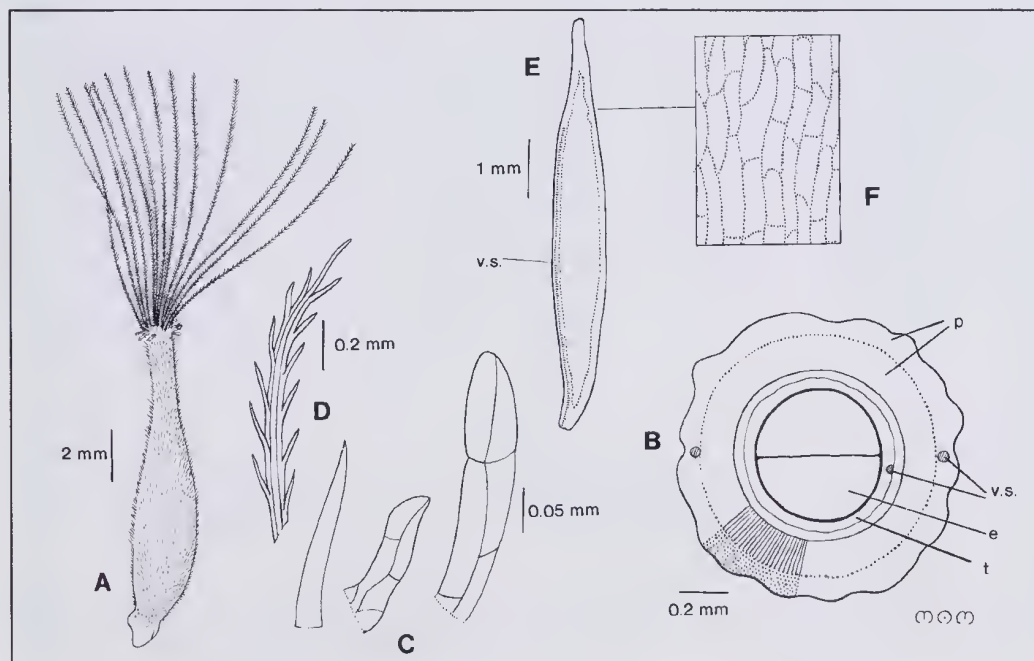


Figure 3. *Lawrencella davenportii*. A - achene with pappus. B - T.S. achene (semidiagrammatic). C - trichomes from achene (left papilla from surface of achene, centre and right from near apex of achene). D - Apex of pappus bristle. E - seed (i.e. testa). F - epidermal cells of testa. (v.s. - vascular strand, p - pericarp, t - testa, e - embryo.) From A.S. George 3924.

Lawrencella davenportii (F.Muell.) Paul G. Wilson, comb. nov. (Figures 1 & 3)

Helichrysum davenportii F.Muell., Fragn. 3:32(1862). - *Helichrysum lawrencella* var. *davenportii* (F.Muell.) Benth., Fl. Austral. 3:616(1867). - *Helichrysum roseum* (Lindley) Druce var. *davenportii* (F.Muell.) Domin, Vestn. Kral. Ceske Spolecn. Nauk. Tr. Mat.-Pir. 2:120(1923). Type citation: 'In Australia centrali ad flumen Neales. J.Macd. Stuart.' *Lectotype* (here chosen): Neales River (MEL 579934; *isolecto*: MEL s.n.).

Bellida major S.Moore, J. Bot. 55:100(1917). Type citation: 'Western Australia, Mulline; J.E.C. Maryon, 1916.' Type n.v.

Distribution. Found in Western Australia, Northern Territory, and South Australia.

Lawrencella rosea Lindley, *loc.cit.* (Figures 1 & 4)

Helichrysum lawrencella Benth., Fl. Austral. 3:616(1867) *nom.illeg.* - *Helichrysum roseum* (Lindley) Druce, Bot. Soc. Exch. Club Brit. Isles 4:626(1917); Domin, Vestn. Kral. Ceske Spolecn. Nauk. Tr. Mat.-Pir. 2:120(1923) *comb.illeg. non* (Hook.) Baillon (1886). - *Helichrysum lindleyi* H. Eichler, Taxon 12:295(1963). Type: Vasse River, on the South West coast of New Holland, 1839, Mrs Molloy (holo: CGE photo seen).

Distribution. Southern Western Australia.

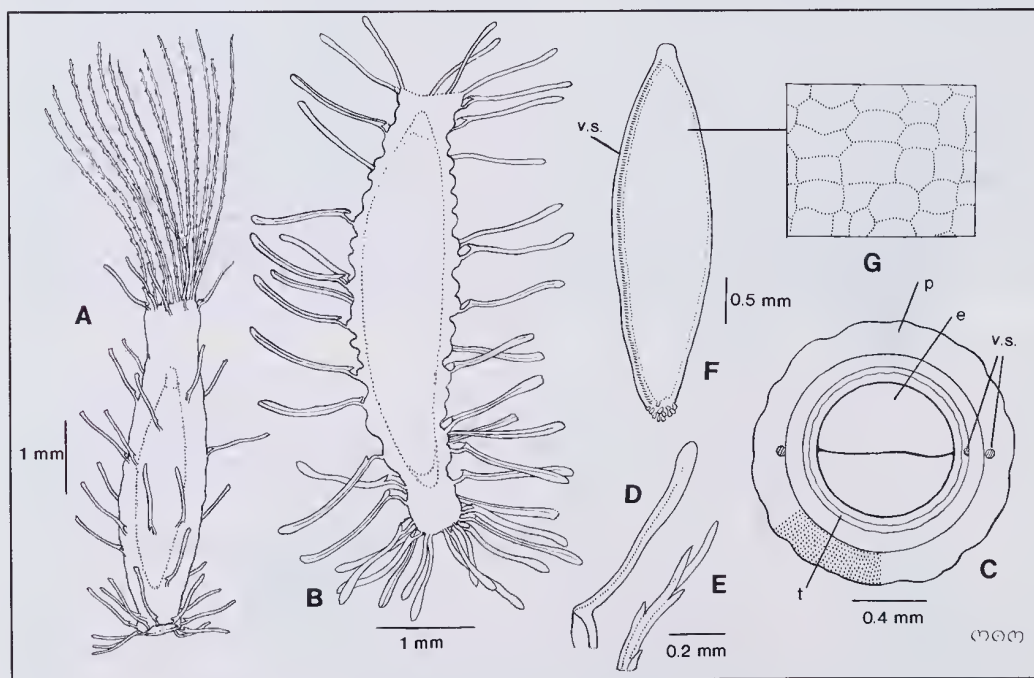


Figure 4. *Lawrencella lindleyi*. A - achene with pappus. B - L.S. achene. C - T.S. achene (semidiagrammatic). D - achenial duplex hair. E - Apex of pappus bristle. F - seed (i.e. testa). G - epidermal cells of testa. (v.s. - vascular strand, p - pericarp, t - testa, e - embryo.) From P.G. Wilson 12353.

Schoenia Steetz in Lehm., Pl.Preiss. 1:480(1845).

Pteropogon sect. *Schoenia* (Steetz) F.Muell., Linnaea 25:415(1853). - *Helichrysum* sect. *Schoenia* (Steetz) Baillon, Hist.Pl. 8:175(1882). *Lectotype* (here chosen): *Schoenia oppositifolia* Steetz [= *S. cassiniana* (Gaudich.) Steetz].

Xanthochrysum Turcz., Bull. Soc. Imp. Naturalistes Moscou 24/1:199(1851). *Type*: *Xanthochrysum filifolium* Turcz.

Helipterum sect. *Geniosperma* A.Gray, Hooker's J. Bot. Kew Gard. Misc. 4:230(1852). *Type*: *Helipterum tenellum* A.Gray

Pteropogon sect. *Helipteropsis* F. Muell., Linnaea 25:415(1853). *Lectotype* (here chosen): *Pteropogon ramosissimus* F. Muell.

Annual erect herbs, hirtellous with short uniseriate hairs that, when young, bear a curled filamentous apiculum producing a woolly cover, or shortly hirsute, or glandular puberulous. Leaves opposite or alternate, oblong or terete. Capitula solitary or corymbiform. Involucre hemispherical to narrow-cylindrical, radiant or not; bracts c. 5-seriate, sometimes woolly ciliate, otherwise glabrous or puberulous on the stereome of the outer bracts; outer bracts scarious-ovate, glossy with a triangular green flat stereome. Inner bracts present or absent: claw oblong, scarious with an oblong stereome; lamina elliptic, pink or yellow (or white). Receptacle convex, glabrous or glandular papillose. Florets actinomorphic, the outer bisexual and the inner male. Corolla narrow-cylindrical with narrow-turbinate limb, 5-lobed, sparsely glandular-puberulous; lobes papillose or colliculate within, vascular strands extending to tip. Anthers: appendage cordate, proximal cells \pm equilateral and thick-walled, medial and distal cells oblong and thin-walled, marginal cells small and equilateral; collar narrow-oblong; tails extremely fine and exceeding the collar. Style apex deltoid, acute, papillose, vascular strand stout and extending to tip. Achene terete to compressed-obovoid, sparsely to densely hirsute with somewhat rigid hairs, short gland-tipped hairs also present; apical margin sometimes raised and surrounding base of pappus; pericarp cartilaginous, thin and crustaceous, or papery, vascular strands in centre of ventral and dorsal faces and in medial position; carpodium annular, insignificant; base not excavated; seed free from or adherent to pericarp. Testa thinly coriaceous, vascular strand 2/3 or completely encircling seed in the medial position. Pappus bristles narrow-linear at base and filiform towards apex, dentate, colourless or yellow, free but united in a short ring at base, persistent or deciduous (persistent on the sterile achenes).

Five species endemic to Australia.

Schoenia subgroup

Schoenia ayersii (F. Muell.) J. Black, Trans. & Proc. Roy. Soc. S. Australia 39:840(1915). (Figures 1 & 5)

Helichrysum ayersii F. Muell., Fragm. 8:167(1874). *Type* citation: 'In vicinia montis Olgae; Gosse'. *Type*: Gosse's Exped., 1873 (holo: MEL).

Podolepis georgei Diels, Bot. Jahrb. Syst. 35:619(1905). *Type* citation: 'Hab. in distr. Austin pr. Murrinmurrin, unde misit cl. W.J. George (Hb. Berol!)'. *Type non vidi*.

Distribution. Found in southern Western Australia, Northern Territory, and South Australia.

A species readily distinguished from *Podolepis*, in which genus it was placed by both Diels (1905) and Davis (1957), by its triangular style apex and its turbinate rugose achenes with coarse hairs.

Schoenia cassiniana (Gaudich.) Steetz in Lehm., Pl. Preiss. 1:481(1845). - *Helichrysum cassinianum* Gaudich. in Freyc., Voy. Uranie 466 t.87(1830). - *Helipterum cassinianum* (Gaudich.) DC., Prod. 6:216(1838). - *Pteropogon cassinianus* (Gaudich.) F. Muell., Linnaea 25:415(1853). *Lectotype* (here chosen): Baie des Chiens-Marins, C.Gaudichaud (P photo seen, isolecto G-DC photo scen). (Figures 1 & 6)

Schoenia oppositifolia Steetz in Lehm., Pl. Preiss. 1:480(1845). - *Pteropogon oppositifolius* (Steetz) F. Muell., Linnaea 25:415(1853). Type citation: 'Specimina integra leg. cl. Roë in Australasia australi-occidentali inter flumen Swan-river et sinum regis Georgii III. (V.s. in herb. aulico Vindobonnensi!)', non vidi.

Distribution. Found in Western Australia, Northern Territory, and South Australia.

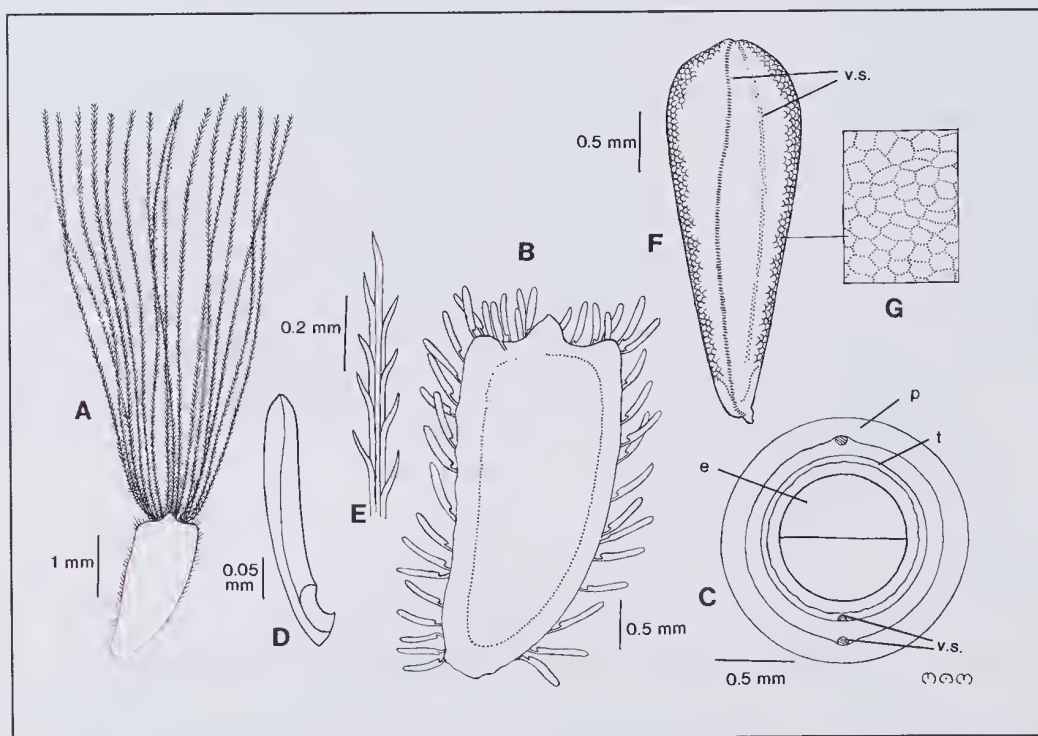


Figure 5. *Schoenia ayersii*. A - achene with pappus. B - L.S. - achene. C - T.S. achene (semidiagrammatic). D - achenial duplex hair. E - apex of pappus bristle. F - seed (i.e. testa). G - epidermal cells of testa. (v.s. - vascular strand, p - pericarp, t - testa, e - embryo.) From H. Demarz 6588.

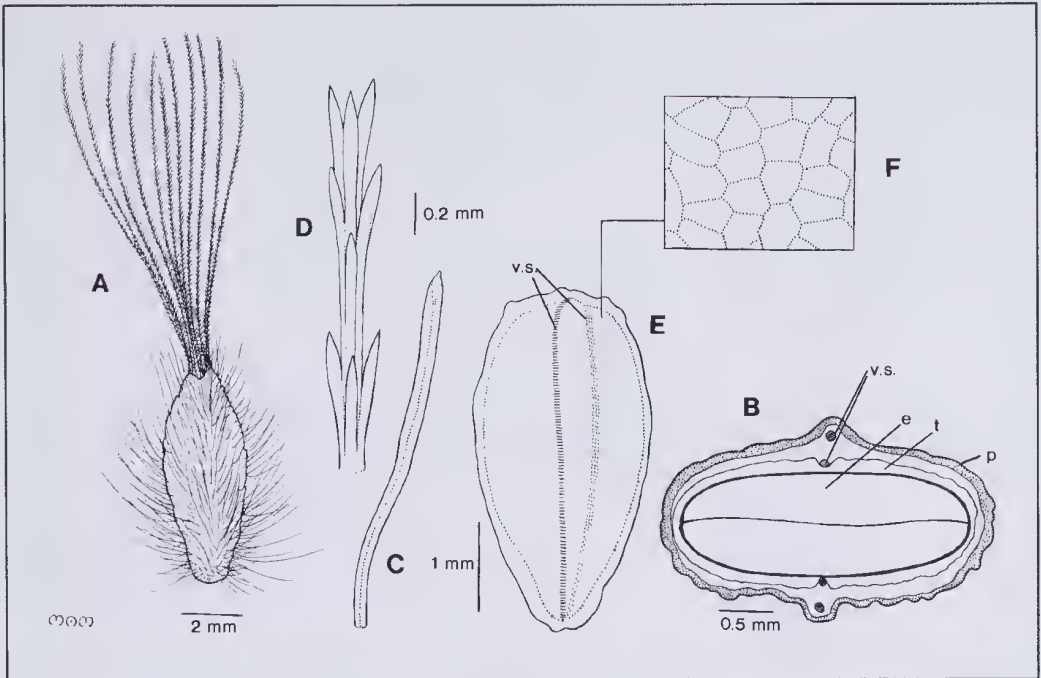


Figure 6. *Schoenia cassiniana*. A - achene with pappus. B - T.S. achene (semidiagrammatic). C - achenial duplex hair. D - apex of pappus bristle. E - seed (i.e. testa). F - epidermal cells of testa. (v.s. - vascular strand, p - pericarp, t - testa, e - embryo.) From P.G. Wilson 12600.

Xanthochrysum subgroup

***Schoenia filifolia* (Turcz.) Paul G. Wilson, comb. nov. (Figures 1 & 7)**

Xanthochrysum filifolium Turcz., Bull. Soc. Imp. Naturalistes Moscou 24/1:199 t.4(1851). - *Helichrysum filifolium* (Turcz.) F. Muell., Fragm. 3:134(1863). - Type: Western Australia, J. Drummond 3rd coll. no. 119 (holo: KW photo seen; iso: K, MEL, NSW).

Helipterum tenellum A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:231(1852) *nom. illeg. non* Turcz. (1851). Type: 'Swan River, Drummond' (holo: K).

Helichrysum subulifolium F. Muell., Fragm. 3:134(1863). Type citation: 'Ad sinum Champion Bay Australiae occidentalis. P. Walcott.' Type: Champion Bay, P. Walcott (holo: MEL; iso: K).

Helichrysum turbinatum W. Fitzg., J. W. Austral. Nat. Hist. Soc. No.1:23(May 1904). - *Helichrysum pseudoturbinatum* C. Gardner, Enum. Pl. Austral. Occ. 133(1931) *nom. illeg.* Type: Nannine, Sept. 1903, W.V. Fitzgerald (iso: PERTH).

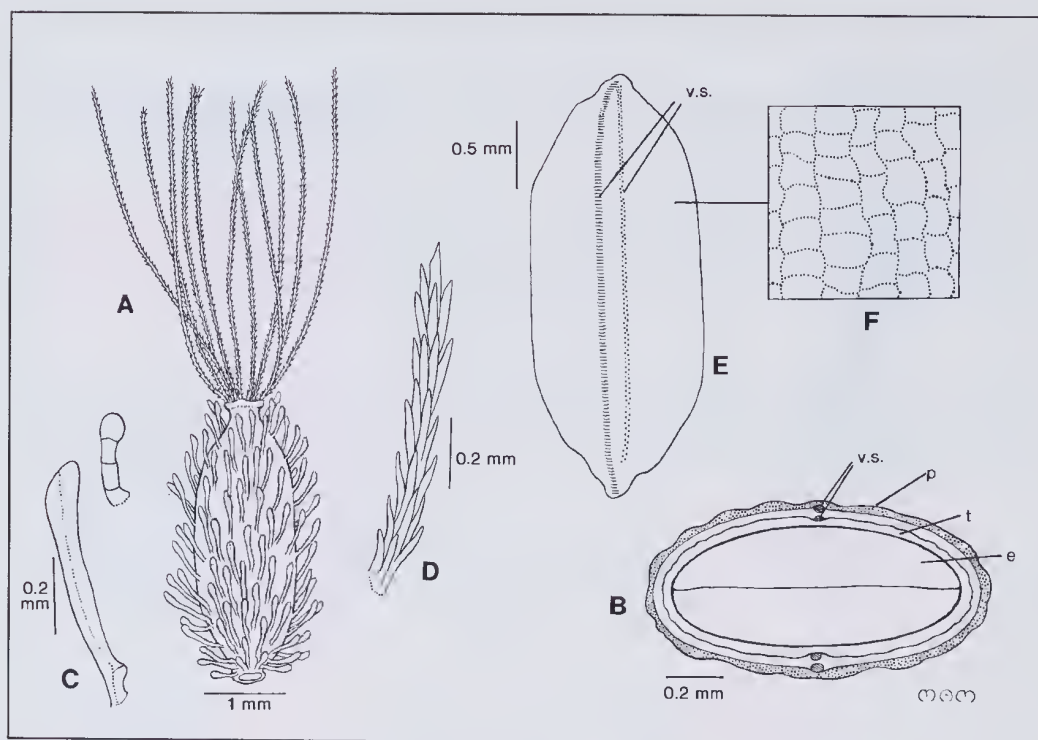


Figure 7. *Schoenia filifolia* subsp. *subulifolia*. A - achene with pappus. B - T.S. achene (semidiagrammatic). C - achenial duplex hair. D - apex of pappus bristle. E - seed (i.e. testa). F - epidermal cells of testa. (v.s. - vascular strand, p - pericarp, t - testa, e - embryo.) From A. Morrison, 30.ix.1904.

Key to subspecies

1. Involucre turbinate to cylindrical; ray 3-6 mm long
 2. Plant single-stemmed; involucre turbinate subsp. *filifolia*
 2. Plant multi-stemmed; involucre cylindrical subsp. *arenicola*
1. Involucre hemispherical; ray 7-10 mm long subsp. *subulifolia*

subsp. *filifolium*

Helipterum tenellum A. Gray, *l.c.*

Helichrysum turbinatum W. Fitzg., *l.c.* - *Helichrysum pseudoturbinatum* C. Gardner, *l.c.*, *nom. illeg.*

Distribution and habitat. Inland south-west Western Australia from Mullewa to Kalgoorlie and Lake Barker in saline areas.

The typical variant of subsp. *filifolium* has obovoid achenes and yellow ray laminae 4-6 mm long whereas the variant represented by the type of *H. turbinatum*, which is immature and only known from that collection, possibly differs in having short (c. 3 mm long) white laminae to the inner involucre bracts, and narrow, quadrangular, very sparsely hispidulous achenes. Its type was collected 'in crevices of rocks along the shores of a salt lake'.

In the above taxonomy subsp. *filifolia* remains somewhat variable in morphology even with the segregation of the other two subspecies, however, it is not at present reasonable to describe further infraspecific taxa since only a few collections have been made.

subsp. *arenicola* Paul G. Wilson, subsp. nov.

Herba erecta supra basim ramosa ad 30 cm alta. Inflorescentia laxa corymbosa. Involucrum cylindraceum c. 7 mm altum; bractea intima laminis ovatis luteis c. 5 x 2.5 mm. Achenium teres, pilis duplicibus crassis c. 0.2 mm longis.

Typus: Western Australia, 5 miles S.E. of Carnarvon, 4 Sept. 1959, *N.T. Burbidge* 6502 (holo: PERTH; iso: BRI, CANB).

Annual erect herb branching above, to 30 cm high. Inflorescence of open corymbs. Involucre cylindrical, c. 7 mm high; innermost bracts a with yellow ovate lamina c. 5 x 2.5 mm. Achenes terete; duplex hairs thick, c. 0.2 mm long.

Additional collections seen. WESTERN AUSTRALIA: Champion Bay, 1889, *Mrs Forrest* (MEL 110575); Carnarvon, Sept./October 1964, *T.Nysen* (PERTH).

Distribution and habitat. Evidently confined to sandhills in the Carnarvon area of Western Australia. The collection from Champion Bay, if the locality data is correct, indicates that it was once found as far south as Geraldton.

Derivation of epithet. The epithet *arenicola* (sand dweller) refers to the plant's habitat preference.

This subspecies differs from subsp. *filifolia* in being single-stemmed (not with several major branches), in having a cylindrical involucre (not turbinate or hemispherical), and in having terete achenes with short (c. 0.2 mm long) duplex hairs (not obovoid and with hairs c. 0.4 mm long).

subsp. *subulifolia* (F. Muell.) Paul G. Wilson, comb. et stat. nov.

Helichrysum subulifolium F. Muell., *Fragm.* 3:134(1863). Type citation: 'Ad sinum Champion Bay Australiae occidentalis. P. Walcott.' *Type*: Champion Bay, *P. Walcott* (holo: MEL; iso: K).

Distribution. Western Australia, Geraldton district.

The typical variant of this subspecies differs from subsp. *filifolia* in having much larger capitula and larger achenes with longer and more dense hairs, but some collections suggest that the two subspecies grade into each other.

Schoenia macivorii (F. Muell.) Paul G. Wilson, comb nov.

Helichrysum macivorii F. Muell., S. Sci. Rec.3:99(1883). *Type*: Gascoyne River, 1882, J. Forrest (iso: MEL two sheets, PERTH).

Distribution and habitat. Gascoyne River area on sand or loam.

Schoenia ramosissima (F. Muell.) Paul G. Wilson, comb. nov.

Pteropogon ramosissimus F. Muell., Linnaea 25:412(1853). - *Helichrysum semifertile* F. Muell., Rep. Pl. Babbage Exped. 14(1859) - *Helichrysum ramosissimum* (F. Muell.) Druce, Bot. Exch. Club Brit. Isles 4:626(1917) *nom. illeg. non Helichrysum ramosissimum* Hook.(1848). *Type citation*: 'In planitiebus arenoso-argillaceis inter montes Flinders-range et sinum Spencers-gulph etiam non procol a rupe Cudnaka.' *Lectotype* (here chosen): In planitiebus valibusque sterilibus prope Cudnaka et Wallendunga, Oct. [18]51, Dr M[ueller] (MEL 604822). *Paralectotypes*: Cudnaka, Nov. Holl. austr. inter., F. Mueller (MEL); Inter montis Flinder's & Sinum Spenceri, Oct. [18]51, F. Mueller (MEL).

Helichrysum semifertile var. *xanthoglossum* F. Muell., Rep. Pl. Babbage Exped. 14(1859). *Type citation*: 'Wonnomulla, Elizabeth Creek'. *Type*: Smith's Waterhole, anon. (holo: MEL).

Distribution. Found in Northern Territory, Queensland, New South Wales and South Australia.

This species has a variant with white and a variant with yellow bract ray laminae. All of the syntypes of *Pteropogon ramosissimus* have white laminae and evidently for this reason Mueller described as a variety a yellow-rayed plant collected on the 'Babbage' expedition.

The presumed holotype of *H. semifertile* var. *xanthoglossum* is a small specimen mounted in a blue packet that is labelled '*Pteropogon ramosissimus* β *flavissimus*, Smith's Waterhole'; it bears no other information. Smith's Waterhole is one of the localities visited by B. H. Babbage on his expedition in 1858. The locality is also referred to in the 'Report' by the Aboriginal name Wirra-Wirralu which is stated to be near Elizabeth Creek, the place name mentioned by Mueller in his protologue to var. *xanthoglossum*. Since the specimen agrees with Mueller's description, and is the only collection in herb MEL of that species from the 'Babbage' expedition, I am confident that it is the type.

Acknowledgements

I am grateful to Arne Anderberg, Laurie Haegi and Jim Armstrong, who made many constructive comments on an early manuscript, and to Margaret Menadue who provided the illustrations. The figures of some of the transverse sections of achenes were based on slides kindly provided by Phil Short.

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**The classification of Australian species currently included in
Helipterum and related genera (Asteraceae: Gnaphalieae): Part 1**

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Abstract

Wilson, Paul G. The classification of Australian species currently included in *Helipterum* and related genera (Asteraceae: Gnaphalieae): Part 1. Nuytsia 8(3): 379-438 (1992). The name *Helipterum* DC. is recognised as being illegitimate and not applicable to Australian taxa. The Australian species currently included in that genus and in the related genera *Cephalipterum*, *Gilberta*, *Triptilodiscus* and *Pterochaeta* are reclassified. One genus, *Haptotrichion*, is described as new. Under *Rhodanthe* 11 sections are recognised of which 1 is new and 10 are new combinations. Eight new species of *Rhodanthe* and one new species of *Haptotrichion* are described, these are *R. ascendens*, *R. collina*, *R. cremea*, *R. gossypina*, *R. nullarborensis*, *R. psammophila*, *R. rufescens*, *R. sphaerocephala* and *H. colwillii*. A number of new species combinations are made. Descriptions are given for each of the recognised genera and sections.

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Introduction

As has been pointed out by many syantherologists (Hilliard & Burt 1981, Anderberg 1989, 1991, Wilson 1989a), the genera *Helipterum* Lindley (1836), *Helipterum* DC. (1838) and *Helichrysum* Miller, in the strict sense, do not occur in Australia and, in any event, the first name is illegitimate and is to be typified by a South African species currently placed in *Helichrysum* (Wilson 1989a), while the second is illegitimate and is to be typified by a South African species of *Syncarpha* DC. (Nordenstam 1989).

The difference between the genera *Helipterum* DC. and *Helichrysum*, as enunciated by A. de Candolle (1838), is that in *Helipterum* the pappus bristles are plumose whereas in *Helichrysum* they tend to be barbellate, or plumose only at the apex. A strict interpretation of this distinction can lead to a placement of related species into separate genera, although the distinction has meant that closely related species have usually been placed together in either *Helipterum* or in *Helichrysum*.

In order to classify the species currently included in *Helipterum* and *Helichrysum* it has been necessary to study related genera of the Gnaphalieae (*sensu* Anderberg 1989) such as *Leptorhynchus*, *Ixiolaena*, *Waitzia*, *Podolepis*, *Podotheca*, *Myriocephalus*, as well as several monotypic genera.

The revised classification has resulted in the recognition of additional genera and the rearrangement of the species currently in *Helipterum* and *Helichrysum*. Some of the resulting genera are being revised by other botanists whose work I do not wish to compromise by producing a comprehensive classification lacking in the information that they will be able to provide. Therefore in this paper I am formally treating a portion of the *Helipterum* complex while indicating the genera into which other species currently included in *Helipterum* are likely to be transferred.

The classification that follows for a portion of the *Helipterum* complex in Australia attempts to associate closely related species and to segregate as distinct genera those species or groups of species that exhibit marked morphological discontinuity. In *Rhodanthe* I have not been successful in interpreting the phylogenetic significance of the varied morphological forms that are adopted by homologous organs. In the achene, for example, the pericarp and testa can have many different textures and structures (Short *et al.* 1989), yet to generically separate taxa that have dissimilar achenes can lead to the separation of species which otherwise have markedly similar florets and similar bract morphologies. For this reason I have adopted a sectional rank for taxa that may later be shown to deserve generic rank and which were sometimes so accorded by early 19th century taxonomists.

I have not attempted to place all the genera of the 'Angiantheae' *sensu* Bentham (1867) in context with those of the *Helipterum* complex but it is obvious that a close relationship often exists. This type of synoptic work will have to be done by others; my principal concern is to provide a classification that can be used for a 'Flora of Australia' treatment and, from the pressure of time alone, many interesting phylogenetic avenues must remain unexplored.

This paper considers the *Rhodanthe*, *Hyalosperma* and *Triptilodiscus* groups of species, most of which have, in general, been placed in *Helipterum*. These groups can be informally categorized as follows.

***Rhodanthe* group:** Inner involucre bracts with broad flat claws; anthers with fine filamentous tails; achenes with normal (mostly not thickened) duplex hairs. Species in this group, with the exception of *Rhodanthe citrina*, that have been examined, do not form ectomycorrhiza (Warcup 1990).

***Hyalosperma* group:** As above, however, achenes lacking normal duplex hairs but with 2-celled bulbous papillae that are frequently myxogenic; pappus shed entire. Species in this group that have been examined form ectomycorrhiza (Warcup *op.cit.*)

***Triptilodiscus* group:** Species in this group have achenes with 2-celled tooth-like trichomes and oblong or boat-shaped claws to the involucre bracts. Other characters suggest that the included genera may not be closely related and that the group is polyphyletic; this therefore becomes a grouping of convenience. In only *Triptilodiscus* has the mycorrhizal association been investigated; it was found to form ectomycorrhiza (Warcup *op.cit.*).

The genus *Rhodanthe*, which is by far the largest of the segregate genera, is circumscribed to contain the majority of the Australian species previously included in *Helipterum*. Some of the remaining species are listed under other genera in this paper. Those species excluded from the present treatment are as follows:

Helipterum albicans (Cunn.) DC., *Helipterum fitgibbonii* F. Muell., *H. molle* (DC.) Paul G. Wilson, and *H. stipitatum* (F. Muell.) Benth. have been transferred to *Leucochrysum* (DC.) Paul G. Wilson, (see Wilson 1992a) a genus closely related to *Waitzia*.

Helipterum niveum Steetz is closely related to *Helichrysum obtusifolium* Sonder; both species will be segregated, with others, in a genus to be described.

Helipterum saxatile Paul G. Wilson is closely related to *Helichrysum podolepidium* F. Muell., these two species will, with others, be placed in a genus to be described.

Helipterum craspedioides is conspecific with *Myriocephalus morrisonianus* and is possibly best recognised as a member of the genus *Polycalymma* (but see Short *et al.* 1989 and Anderberg 1991).

Helipterum adpressum W. Fitzg. (= *Helichrysum puteale* S. Moore) and *Helipterum pterochaetum* (F. Muell.) Benth. have been transferred to the genus *Chrysocephalum* Walp. as *C. puteale* (S. Moore) Paul G. Wilson and *C. pterochaetum* F. Muell. (see Anderberg 1991 and Wilson, Short & Orchard 1992).

The species that are here placed in *Rhodanthe* form a polymorphic assemblage that is divided into eleven sections. Some of the sections that have obvious problems associated with them are briefly discussed below.

The sect. *Monencyanthes*, in which the achenes are persistent and the capitula caducous, contains three species. These species probably attained their specialised condition independently for each has features that suggest derivation from a different ancestor possibly of the *Achyroclinoides* type.

The species in sect. *Leiochrysum* are diverse in vegetative and floral morphology. The organs appear to vary in morphology independently from each other and I have been unable to correlate characters in a manner that would achieve a more natural classification.

The sect. *Helichrysoides* appears to be a monophyletic group which, at one extreme has affinity to the genus *Podotrochea* and, at the other, to species in sect. *Leiochrysum*. Its correct taxonomic status is uncertain (see also Anderberg 1991).

Each of the sections *Anisolepis* (1 sp.), *Actinaria* (2 spp.), and *Helipteridium* (1 sp.), has very distinctive involueral bracts but each shows little difference in floral morphology to certain species in sect. *Achyroclinoides*; I have therefore included these sections in *Rhodanthe* rather than give them generic status.

The sect. *Citrinae*, with the single species *R. citrina*, has been difficult to place. Due to the beaked apex to its achene this species has been previously included in *Waitzia*. It differs radically from *Waitzia* in that the involueral bracts have flat claws with an undivided sterome (fide Anderberg 1991), the style apex is truncate, and the achenes pilose. It differs from other species of *Rhodanthe* in sometimes having the outer florets female (not hermaphrodite) and in being an ectomycorrhizal species (Wareup 1990). Both these characters suggest a relationship with species such as *Chrysocephalum apiculatum* (Labill.) Steetz and *Leucochrysum albicans* (Cunn.) Paul G. Wilson, but the morphology of the achenes and corollas of the three species is quite different. It possibly deserves recognition as a distinct genus.

Rhodanthe polyphyllum, which is placed in the monotypic section *Polyphyllum*, is a further anomaly since it has stout, branched anther tails and clustered, filiform leaves. It appears to have no close relative in the *Helipterum*-*Helichrysum* complex. Nevertheless I have included it in *Rhodanthe* with which it appears to have greatest affinity. Again, it may deserve recognition as a distinct genus.

Catalogue of taxa

In this Catalogue I have listed the accepted names and their synonyms in the *Rhodanthe*, *Hyalosperma* and *Triptilodiscus* groups. For new taxa and for all genera and sections I have provided descriptions. Where it has been necessary I have lectotypified names.

The *Rhodanthe* group

Rhodanthe Lindley

***Rhodanthe* Lindley**, Bot. Reg. t.1703(1834).

Helichrysum sect. *Rhodanthe* (Lindley) Baillon, Hist. Pl. 8:314(1886). Type: *R. manglesii* Lindley

Roccardia Necker ex Voss, Vilm. Blumengärtn. cd.3, 1:530(1895) *nom. illeg. non* Necker ex Raf.(1838). Type: *R. manglesii* (Lindley) Voss [= *Rhodanthe manglesii* Lindley].

Annual or short-lived perennial herbs, woolly, puberulous, pilose, glandular, or glabrous. Leaves mostly alternate, simple, entire, rarely terete. Capitula homogamous or heterogamous, solitary or clustered, radiant or not; subtending leaves, when present, grading into the outer bracts. Involucral bracts multi-seriate, glumaceous or scarious, rarely with a herbaceous tip; claws oblong with narrow or broad undivided stereome (Anderberg 1991). Receptacle glabrous, or pilose around alveolae, predominantly ebracteate. Florets bisexual or the innermost male, otherwise homomorphic. Corolla tubular at base, usually turbinate above, glabrous or sparsely puberulous; lobes 5, equal or not, inner epidermis with cells not oblong in transverse rows. Anther tails filamentous and weak. Style apex truncate to ellipsoid or deltoid. Achene with normal duplex hairs; carpopodium annular or absent. Pappus bristles barbellate to plumose.

1. *Rhodanthe* Lindley sect. *Rhodanthe*

Annual erect herb, glabrous. Leaves cauline, sessile, suborbicular, base decurrent on each side of stem. Capitula heterogamous, solitary on slender branches. Involucre turbinate; bracts multi-seriate, papery, petaloid; claw with scarious margin and narrow-oblong thin stereome. Receptacle rounded, smooth, glabrous. Florets numerous, mainly bisexual but the innermost male, 5-merous. Corolla actinomorphic, glabrous; upper portion cup-shaped; lobes not papillose; veins extending into base of lobes. Stamens: anther appendage cordate, acute, the cells narrow-oblong towards apex, equilateral near base; anther tails filamentous, weak; collar narrow-oblong. Style apex narrow-deltoid, vascular trace not extending to tip. Achene obovoid, dorsiventrally compressed, densely silky to base; carpopodium absent; pericarp thin, translucent, in medial position in relation to the cotyledons; testa thin, translucent, \pm fused to pericarp, the vascular strand extending almost completely around seed; crystals absent. Pappus persistent; bristles plumose, the cilia all acute.

A monotypic section that is most closely related to species in sect. *Leiochrysum*. It is distinctive in being glabrous, in having suborbicular sessile decurrent leaves, and possessing an anther appendage and a style apex that are unique in the genus.

Rhodanthe manglesii Lindley, Bot. Reg. 20: t.1703(1834). - *Helipterum manglesii* (Lindley) Benth., Fl. Austral. 3:640(1867). - *Helichrysum manglesii* (Lindley) Baillon, Hist. Pl. 8:314(1886). - *Argyrocome manglesii* (Lindley) Kuntze, Revis. Gen. Pl. 1:309(1891). - *Roccardia manglesii* (Lindley) Voss, Vilm. Blumengärtn. 3rd edn, 1:531(1895). Type: Swan River Colony, leg. J. Drummond, n.v.

Rhodanthe atrosanguinea J. Drumm. ex hort., Gard. Chron. no. 27:622(1861). Type: Limestone Hills, Champion Bay, W.A., J. Drummond, n.v.

Rhodanthe manglesii var. *sanguinea* Hook., Bot. Mag. 87:t.5283(1861). - *Roccardia manglesii* f. *sanguinea* (Hook.) Voss, Vilm. Blumengärtn. 3rd edn, 1:531(1895). Type: Western Australia, J. Drummond, n.v.

Roccardia manglesii f. *ligulosa* Voss, Vilm. Blumengärtn. 3rd edn, 1:531(1895). Type: not indicated.

Helipterum cryptanthum O. Sarg., J. Bot. 61:285(1923). Type: Mt Brown, York, Western Australia, O. Sargent 1404 (holo: BM; ?iso: MEL 109635 Sargent 1404a).

2. *Rhodanthe* sect. *Monencyanthes* (A. Gray) Paul G. Wilson, comb. nov.

Monencyanthes A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:229(1852).

Helipterum sect. *Monencyanthes* (A. Gray) Benth., Fl. Austral. 3:648(1867). Type: *Monencyanthes gnaphalioides* (Hook.) A. Gray

Annual herbs, variably woolly. Leaves cauline, linear to narrow-oblong, entire. Capitula heterogamous, sessile or subsessile in terminal glomerules, caducous. Involucre ellipsoidal, narrow-cylindrical, or cup-shaped, not radiant; bracts scarious, woolly ciliate, the inner with linear hard claw. Receptacle insignificant or rounded, with or without receptacular bracts. Florets 1-c. 12, bisexual or male, 5-merous. Corolla actinomorphic, cylindrical or narrow-turbinate, glabrous. Stamens: anther appendage broad ovate, obtuse, the cells narrow-oblong, thin-walled; anther tails filamentous, weak. Style apex truncate, papillose. Achene ellipsoidal, c. 2.5 mm long, persistent on receptacle, sparsely short pilose; carpodium absent; pericarp membranous, hyaline, and with crystals (*M. maryonii*) or outer layer with thickened brown radial walls and crystals absent, nerves medial or medial-oblique in relation to cotyledons (Short *et al.* 1989); testa membranous and fused to pericarp or somewhat leathery and free (*M. maryonii*), crystals present. Pappus persistent, the bristles plumose weak with a few long cilia.

Notes. This taxon was treated in a very broad sense as a section of *Helipterum* by Bentham (1867) so as to include some species now placed in *Chrysocephalum*, *Rhodanthe* sect. *Achyroclinoideis*, and *Hyalosperma*. I have restricted it to those species with a woolly indumentum, and caducous capitula with persistent shortly hirsute achenes that have a persistent pappus. The included species, though superficially similar, probably arose independently from different species with caducous achenes since in the microscopic structure of the corolla each displays a significantly different morphology. It is interesting that in the achene of *R. maryonii* the pericarp bears crystals (presumably of calcium oxalate) whereas in all other species of *Rhodanthe* that have crystals in the achene they are found only

in the testa. Short *et al.* (1989) record that of the members of the Inuleae that they examined, crystals in the pericarp were only found in *Craspedia* aff. *pleiocephala*.

Rhodanthe moschata (Cunn. ex DC.) Paul G. Wilson, comb. nov.

Gnaphalium moschatum Cunn. ex DC., Prod. 6:236(1838). - *Helipterum mosehatum* (DC.) Benth., Fl. Austral. 3:648(1867). *Argyroeome moschata* (DC.) Kuntze, Revis. Gen. Pl. 1:309 (1891). *Type*: Molle's Plains, Lachlan River, Interior of New South Wales, 1817, A. Cunningham (holo: G-DC photo seen).

Calocephalus gnaphalioides Hook. in T. Mitch., J. Exped. Int. Trop. Austral. 378(1849). - *Monenyanthes gnaphalioides* (Hook.) A. Gray, Hooker's J. Bot. Kew Gard. Misc. 6:230(1852). *Type*: T.L. Mitchell, n.v.

This species is often confused with *R. tietkensii* which may be distinguished by its more numerous florets (c. 10 to a head), and absence of prominent glandular hairs on the corolla lobes. In *R. moschata* there are c. 3 florets to a capitulum (1 or 2 bisexual) and prominent glands on the lobes.

A collection from the Simpson Desert, Northern Territory (*G. Chippendale*, NT 6577, herb. AD) appears to be a hybrid between *R. tietkensii* and *R. mosehata*. The herb. NT duplicate of this collection is of true *R. moschata*. *Rhodanthe tietkensii* has been found in the same area.

Material collected in northern Eyre Peninsula, South Australia, differs from the common variant in having milky white (not scarious) involucre bracts.

Rhodanthe uniflora (J. Black) Paul G. Wilson, comb. nov.

Helipterum uniflorum J. Black, Trans. & Proc. Roy. Soc. South Australia 41:651 t.43(1917). *Lectotype* (here chosen): Kopperrmannna, 7 Oct. 1916, S.A. White (AD 98625090 p.p.), isolecto: MEL 110472, NSW 181468.

Rhodanthe maryonii (S. Moore) Paul G. Wilson, comb. nov.

Helipterum maryonii S. Moore, J. Linn. Soc. Bot. 45:182(1920). *Type*: Mulline, J.E.C. Maryon (holo: BM; iso: MEL 110713, NSW 181424).

3. *Rhodanthe* sect. *Leiochrysum* (DC.) Paul G. Wilson, comb. nov.

Helipterum sect. *Leiochrysum* DC., Prod. 6:216(1838). *Lectotype* (here designated): *Helipterum polygalifolium* DC. [= *Rhodanthe polygalifolia* (DC.) Paul G. Wilson].

Helipterum sect. *Sericophorum* DC., Prod. 6:216(1838). *Lectotype* (here designated): *Helipterum humboldtianum* (Gaudich.) DC. [= *Rhodanthe humboldtiana* (Gaudich.) Paul G. Wilson].

Pteropogon DC., Prod. 6:245(1838). - *Pteropogon* sect. *Facelioides* A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:267(1852) *nom. illeg.* - *Helipterum* sect. *Pteropogon* (DC.) Benth., Fl. Austral. 3:639(1867). *Type*: *P. pygmaeus* DC.

Xyridanthe Lindley, Sketch Veg. Swan Riv. Col. 23(1839). *Type*: *X. stricta* Lindley

Acroclinium A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:270(1852). - *Helichrysum* sect. *Acroclinium* (A. Gray) Baill., Hist. Pl. 8:174, 314(1882); F. Muell., Fragm. 3:32(1862) *nomen*. *Lectotype* (here designated): *A. multicaule* A. Gray [= *Rhodanthe chlorocephala* (Turcz.) Paul G. Wilson].

Griffithia J. Black, Trans. & Proc. Roy. Soc. South Australia 37:122(1913). *Type*: *G. hcliptroides* J. Black [= *Rhodanthe oppositifolia* (S. Moore) Paul G. Wilson].

Annual herbs (rarely short-lived perennial), glabrous or variously pubescent. Leaves linear to oblong, entire. Capitula heterogamous or homogamous, solitary or clustered. Involucre globular to cylindrical or turbinate, radiant or not; bracts multisciate, scarious, papery, or thinly cartilaginous; stereome oblong to linear, thin; claw of inner involucre bracts flat, scarious. Receptacle rounded to conical, smooth or pitted, glabrous or puberulous. Florets 5 to numerous, bisexual, or the innermost male, 5-merous. Corolla actinomorphic to zygomorphic, almost glabrous to variously pubescent, cylindrical or expanded above, cells of inner epidermis of lobes equilateral to broad-oblong, smooth or papillose. Stamens: anther appendage narrow-deltoid to ovate or oblong, cells narrow-oblong; anther tails filamentous, weak; collar oblong or narrow-oblong. Style apex truncate to broadly deltoid, prominently papillose. Achene obovoid, compressed obovoid, or ellipsoid, 1.5-3.5 mm long, densely silky or moderately short pilose; carpodium a short glabrous slightly tumid hollow base or absent; pericarp crustaceous, thinly coriaceous, or papery, vascular strands in medial or oblique position; testa membranous to thinly coriaceous, free from or fused to pericarp, the vascular strand 1/2 to 3/4 encircling seed; crystals in testa present or absent. Pappus persistent or caducous; bristles linear-lanceolate, plumose, the terminal cilia frequently rounded or clavate.

Note 1. Candolle (1838) placed *Helipterum polygalifolium* and *H. diffusum* in his section *Leiochrysum*, I have selected the first of these as the lectotype since it better agrees with his sectional description.

Note 2. Gray (1852) included two species in *Pteropogon* sect. *Facelioides* of which one was *P. pygmaeus*, the type of *Pteropogon*. His sectional name is therefore superfluous.

***Rhodanthe anthemoides* (Sprengel) Paul G. Wilson, comb. nov.**

Helichrysum anthemoides Sieber ex Sprengel, Syst. Veg. 3:484(1826). - *Helipterum anthemoides* (Sprengel) DC., Prod. 6:216(1838). - *Argyrocome anthemoides* (Sprengel) Kuntze, Revis. Gen. Pl. 1:309(1891). - *Roccardia anthemoides* (Sprengel) Voss, Vilm. Blumengärtn. 3rd edn, 1:531(1895) 'anthemodes'. *Type*: 'Nov Holl.' probably F.W. Sieber 344 (iso: G-DC photo seen, K, MEL 109048, 604823).

Helipterum punctatum DC., Prod. 6:216(1838). *Type*: Van-Diemen Land, R. Gunn 239 (holo: G-DC photo seen; ?iso: MEL 109067 p.p.).

***Rhodanthe chlorocephala* (Turcz.) Paul G. Wilson, comb. nov.**

Schocnia chlorocephala Turcz., Bull. Soc. Imp. Naturalistes Moscou 24/1:193(March 1851). - *Helipterum chlorocephalum* (Turcz.) Benth., Fl. Austral. 3:641(1867). - *Argyrocome chlorocephala*

(Turcz.) Kuntze, Revis. Gen. Pl. 1:309(1891). - *Roccardia chlorocephala* (Turcz.) Voss, Vilm. Blumengärtn. 3rd edn, 1:530(1896). *Type*: Western Australia, *J. Drummond* 4th coll. n. 199 (iso: MEL 109146, 109147, 109148).

Rhodanthe chlorocephala* subsp. *chlorocephala

[*Acroclinium multicaule* A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:271(1852) as to var. β not as to lectotype. *Syntype*: Swan river, *J. Drummond* (K).]

I am applying the epithet subsp. *chlorocephala* in a narrow sense so as to restrict it to the form represented by the type collection of this taxon. This type was collected from an unknown locality in the south-west of Western Australia; it was included in Drummond's fourth collection which was despatched to England in July 1847. According to Erickson (1969) the fourth collection consisted of plants gathered from King George Sound, Stirling Range, Porongorups, Mt Manypeaks, Cape Riche, West Mt Barren, and from north and east of Moore River. Of these various localities *Rhodanthe chlorocephala* is only known from the Moore River area but the only other specimens I have been able to match with the type are those that represent the original material of *Acroclinium multicaule* A. Gray var. β which is an apparently undated and unnumbered collection of Drummond's in herb. K. It is possible that the specimens that form the bases of *R. chlorocephala* and *A. multicaule* var. β are from the same Drummond collection.

***Rhodanthe chlorocephala* subsp. *rosea* (Hook.) Paul G. Wilson, comb. et subsp. nov.**

Acroclinium roseum Hook., Bot. Mag. t.4801(1854). - *Helichrysum grayi* F. Muell., Fragm. 5:200(1866). - *Helipterum roseum* (Hook.) Benth., Fl. Austral. 3:640(1867). - *Argyrocome rosea* (Hook.) Kuntze, Revis. Gen. Pl. 1:309(1891). - *Roccardia rosea* (Hook.) Voss, Vilm. Blumengärtn. 3rd edn, 1:531(1896). *Type citation*: 'A native of the interior of South-west Australia, between the Moore and Murchison rivers from whence the seeds were sent in 1853 by Mr. James Drummond, together with dried specimens (No. 157 of his Herbarium).' *Lectotype* (here chosen): *J. Drummond* 6th coll. no. 157 (lecto: K; isolecto: NSW 180743). *Syntype*: Hort. Kew. 1854 from *Drummond* S.W. Australia (K).

Acroclinium multicaule A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:271(1852). - *Helichrysum drummondii* F. Muell., Fragm. 5:200(1866). *Lectotype* (here chosen): Swan River, *J. Drummond* (lecto: ?K n.v.; ?iso: P, 'J. Drummond 349', annotated by A. Gray in 1851).

Acroclinium roseum var. *grandiflorum* Nicholson, Ill. Dict. Gard. 1:18(1884). - *Helipterum roseum* var. *grandiflorum* (Nicholson) Chitt., Dict. Gardening 2nd edn, 2:978(1951). *Type*: not indicated.

Acroclinium roseum var. *album* hort. ex Nicholson, Ill. Dict. Gard. 1:18(1884). - *Helipterum album* (Nicholson) L. Bailey, Cycl. Amer. Hort. 2:726(1900). - *Helipterum roseum* f. *album* (Nicholson) Moldenke, Phytologia 2:312(1947). *Type*: not indicated.

Helipterum roseum var. *nigropapposum* Ostenf., Biol. Meddel. Kongel. Danske Vidensk. Selsk. 3/2:140(1921). *Type citation*: 'Perth, King's Park, in open sandy places (No.874; 10.Sept.1914).' (iso: MEL 110494).

[*Helipterum troedelii* var. *patens* Ewart, J. White & B. Rees, Proc. Roy. Soc. Victoria 22 n.s.:15(1909). - *Helipterum roseum* var. *patens* (Ewart *et al.*) J. Black, Trans. & Proc. Roy. Soc. South Australia 45:21(1921) as to syntype 'Fraser Rangc, 1891, R. Helms', not as to lectotype. Syntype: Fraser Range, 4 Oct. 1891, R. Helms (MEL 110705, AD 96343013, NSW 180742).]

The involuclral bracts in this subspecies can be pink or white.

Note. Asa Gray, under *Acroclinium multicaule*, described a variety *a* in which the ray bracts were white, and a variety *β* in which the ray bracts were 'subaeruginosis'. The lectotype cited above is of the var. *a* which corresponds to *R. chlorocephala* subsp. *rosea*, var. *β* is referred to subsp. *chlorocephala*.

Rhodanthe chlorocephala subsp. *splendida* (Hemsley) Paul G. Wilson, subsp. et comb. nov.

Helipterum splendidum Hemsley, Bot. Mag. t.7983(1904). - *Helipterum roseum* var. *album* Ewart *et al.*, Proc. Roy. Soc. Victoria n.s. 23:59(1910) *nom. illeg.* Type citation: 'Kew is indebted to Mr G.F. Berthoud, of Waroona, near Drakesbrook, W. Australia, for dried specimens and seeds of this handsome plant, which he labelled:- "Native of North-western Districts." There are also herbarium specimens collected in open plains at Menzies, about a hundred miles north of Coolgardie, in about 29° 30' S. lat. and 121° E. long., by Cecil Andrews.' *Lectotype* (here chosen): North-western Districts of Western Australia, 26.x.1903, G.F. Berthoud (lecto: K; isolecto: MEL 110704).

Rhodanthe chlorocephala is extremely variable. At one extreme is found in the Shark Bay area of Western Australia a large flowered variant with long (to 30 mm) cream-coloured limbs to the inner involuclral bracts. At the other extreme is found a variant in the Nullarbor area of South Australia and Western Australia with small heads and short (c. 5 mm) white limbs. Between these extremes is a continuity of forms. In addition to the differences in size of the heads and bracts, and the presence of a black spot at the base of the limb in the large cream bracted variant, there are found colour forms that range from white to cream and various shades of pink. Hooker noted that in cultivation *Acroclinium roseum* had much larger heads than the wild plant from which the seed was obtained and this difference is apparent when comparing the Drummond herbarium material with Hooker's illustration.

The variant described by Ostenfeld as *Helipterum roseum* var. *nigropapposum* was collected in Perth; it is almost identical to Drummond's collection no. 157 (from between the Moore and Murchison Rivers) on which the name *Acroclinium roseum* was based.

The name *A. multicaule* A. Gray was based on two variants, as is noted above, of which one corresponds to subsp. *chlorocephala* and the other to subsp. *rosea*.

The name *A. roseum* var. *grandiflorum* Nicholson was based on a large-headed rose-coloured variant while var. *album* Nicholson was based on a white variant, both variants are presumably forms of subsp. *roseum*.

Ewart *et al.* (1909) based the name *H. troedelii* var. *patens* on two collections of which one, the lectotype, is *Rhodanthe troedelii* s.str. while the other (from the Fraser Range in Western Australia) is of the small 'Nullarbor' variant of subsp. *rosea*. It was the latter specimen that J.M. Black first saw

and therefore transferred the variety to *H. roseum* in the first edition of the Flora of South Australia (1929).

***Rhodanthe collina* Paul G. Wilson, sp. nov. (Figure 1)**

Annua erecta ad 20 cm alta. Caules graciles, atro-rubri, sparse puberuli et glanduloso punctati. Folia caulina alterna, aliquantum coriacea linearia vel anguste oblonga, integra, 8-15 mm longa, obtusa, margine saepe recurva, supra glabra, infra glanduloso punctata. Capitula heterogamia, solitaria, terminalia. Involucrum hemisphericum, c. 5 mm altum, radians. Bracteae multi-seriatae, glumaceae glabrae; bracteae intimae: ungue late elliptico c. 5 mm longo, stereomate lineari, duro, lamina oblongo-elliptica c. 6 mm longa, alba. Receptaculum conicum, glabrum. Flosculi numerosi, bisexuales vel masculi. Corolla actinomorpha, anguste cylindracea, c. 3.5 mm longa; lobi 5, triangulares, c. 0.4 mm longi; intra dense papilloso. Antherarum loculi c. 1 mm longi; appendix oblongo-ellipticus, acutus c. 0.4 mm longus, margine minute crosa, cellulis anguste oblongis, tenui-parietibus; caudi tenues, debiles. Styli rami apicem versus aliquantum latiores, apice rotundato longe papilloso, nervo gracili in medio rami terminanti. Achenium obovoideum c. 2 mm longum, atro-rubiginosum, dense albo-hirsutum, pilis crasso-parietibus; carpophorum annulare; pericarpium crustaceum; testa membranacea, atro-violaceum, ad pericarpio \pm adnatum. Pappus in statu integro tarde deciduus; setae lineari-acuminatae, breviter plumosae, ciliis terminalibus clavatis.

Typus: Paynes Find - Thundelarra road near Monger Lake, 29° 03' S, 117° 17' E, low hill of quartzite boulders, 27 Sept. 1986, *Paul G. Wilson* 12300 (holo: PERTH; iso: AD, BRI, CANB, K, MEL, NSW).

Annual erect herb to 20 cm high branching at and above base. Major axes slender, dull reddish brown with a few small septate hairs and sessile globular glands. Leaves cauline, alternate, somewhat leathery, linear to narrow-oblong or spatulate, entire, 8 x 0.5 - 15 x 2 mm, obtuse, margin often recurved (at least when dry), glabrous above, sparsely covered below with sessile globular glands and with a few shorter septate hairs on midrib. Capitula heterogamous, solitary on slender leafless terminal peduncles. Involucre hemispherical, c. 5 mm high, radiant; bracts glumaceous, glabrous; outer and intermediate bracts elliptic, to 6 mm long, pale brown, with a short flat stereome; inner bracts: claw broad-elliptic, hyaline, c. 5 mm long with a hard linear stereome c. 2/3 its length; lamina oblong-elliptic, obtuse, c. 6 mm long, 2.5 mm wide, white. Receptacle conical, glabrous. Florets numerous, the outer bisexual and the inner male. Corolla narrow-tubular, somewhat constricted below middle, c. 3.5 mm high, yellow, sparsely puberulous towards base, wall thickened in lower half, vascular strands extending to base of lobes; lobes 5, short erect, triangular, c. 0.4 mm long, all densely papillose within. Stamens: anther loculi c. 1 mm long; anther appendage oblong-elliptic, acute, c. 0.4 mm long, minutely crose on margin, cells narrow-oblong, walls unthickened except for a marginal row of small cells with thickened walls; anther tails very thin and delicate. Style branches broadened towards tip and with a rounded long-papillose apex; vascular strand very slender and terminating about half way along style branch. Achene obovoid, c. 2 mm long, very dark reddish brown, densely white-hirsute with thick-walled hairs, myxogenic; carpodium annular; pericarp crustaceous with lignified reddish brown radial walls; testa very thin and weak, dark mauve, with scattered flat crystals, \pm fused to pericarp. Pappus tardily deciduous as a whole; bristles linear-acuminate, \pm equal to corolla, united in a short ring at base, shortly plumose, the terminal cilia clustered and clavate.

Distribution. Near Yalgoo, central western Western Australia, in the far western area of the Austin Botanical District.

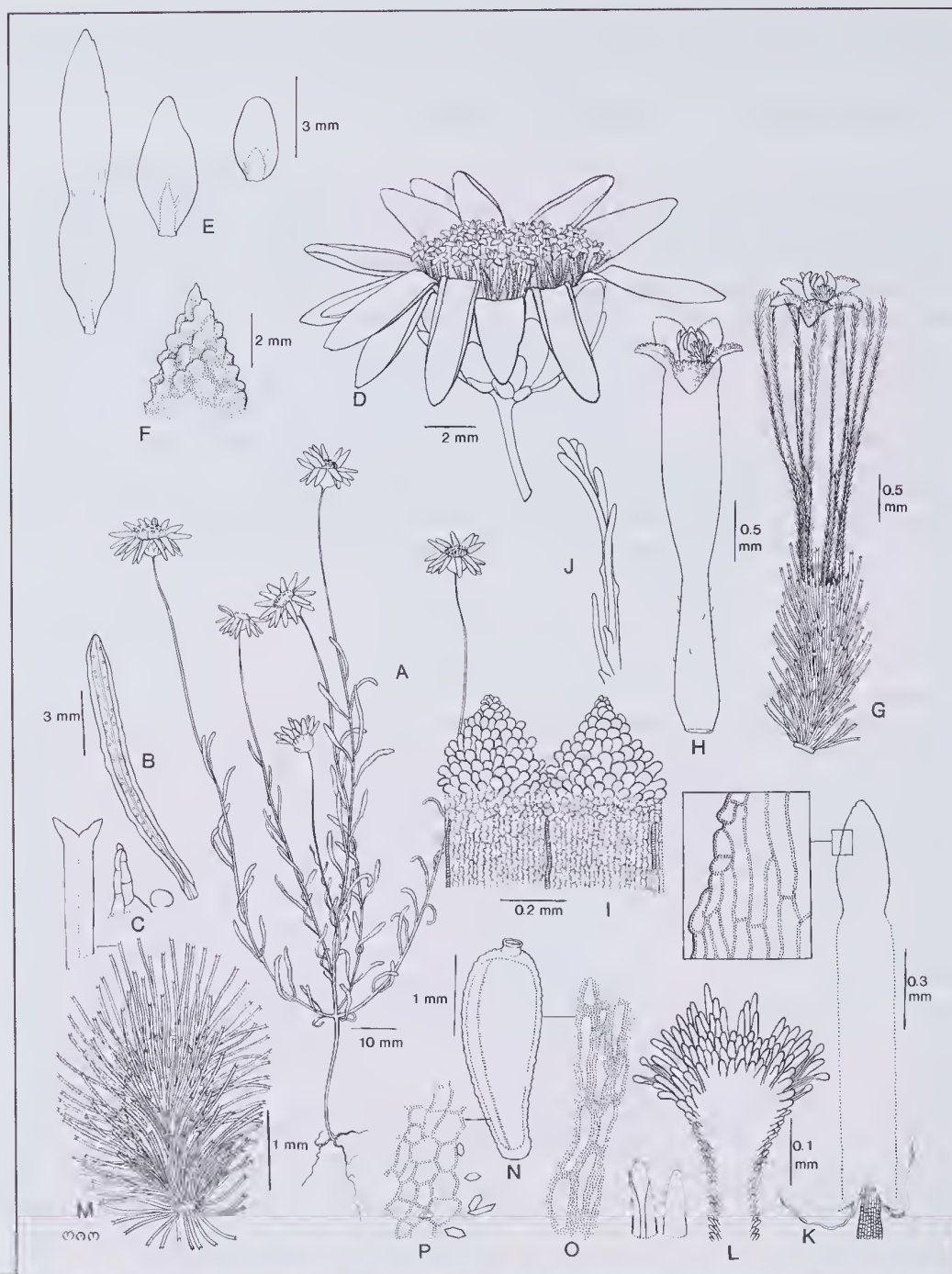


Figure 1. *Rhodanthe collina*. A - Habit. B - Undersurface of leaf. C - Multicellular hispidulous and globular glandular trichomes from undersurface of leaf. D - Capitulum. E - Inner, intermediate, and outer involucre bracts. F - Receptacle. G - Floret. H - Corolla. I - Inner surface of apex of corolla. J - Apex of pappus bristle. K - Anther with enlargement of margin of appendix (tails drawn recurved for space exigencies). L - Apex of style with two papillae enlarged. M - Achene with apex of duplex hair enlarged. N - Achene showing position of seed and of its vascular strand. O - Enlargement of epidermis of pericarp. P - Enlargement of epidermis of testa showing crystals. From B.H. Smith 460.

Specimens examined. WESTERN AUSTRALIA: 112 milc peg on the Yalgoo Road, A.M. Ashby 2976 (AD, PERTH); Mt Gibson, B.H. Smith 460 (MEL, PERTH); Mingencw Hill, 29 Aug. 1957, R.F. Watson (PERTH).

Habitat. On rocky hills in exposed situations.

Notes. This species would appear to have no close relatives although in habit and in indumentum it is similar to *Rhodanthe diffusa*. The unique anther appendages, style apices, and achenes combine to make it a very distinct species.

***Rhodanthe corymbiflora* (Schldl.) Paul G. Wilson, comb. nov.**

Helipterum corymbiflorum Schldl., *Linnaea* 21:448(1848); Sonder, *Linnaea* 25:519(1853). - *Argyrocome corymbiflora* (Schldl.) Kuntze, *Revis. Gen. Pl.* 1:309(1891). - *Roccardia corymbiflora* (Schldl.) Voss, *Vilm. Blumengärtn.* 3rd edn, 1:532(1895). Type citation: 'Dr Behr' [South Australia] (?holo: MEL 604825).

Note. Sonder, *l.c.*, cited the Behr collection as coming from 'Fiedler's section, Novemb.' This locality is in the Hundred of Moorooroo, County Light, near the present town of Nuriootpa (South Australia). The putative type sheet in herb. MEL has on it three specimens, two of which are somewhat etiolated whole plants while one is a single stem off a mature plant. A note on the sheet by Sonder states 'culmi esminibus plantae behrianae!' It would appear likely that the two whole plants represent those raised by Sonder while the single stem is the type specimen collected by Behr since it corresponds to the following comment made by Schlechtendal, *l.c.*, 'Unicum specimen vidi, ramum 5 poll. longum'.

***Rhodanthe cremea* Paul G. Wilson, sp. nov. (Figure 2)**

Annua erecta, c. 25 cm alta, sparse lanosa, pilis glandulosis absentibus. Axes majores graciles, solitarii vel numerosi, haud ramosi, apicem versus lanosi aliter glabri. Folia caulina alterna, integra, linearia vel anguste obovata, acuta vel obtusa, ad 30 mm longa, apicem versus caulorum absentia. Capitula solitaria ad caules terminalia posita. Bractae exteriores scariosae vel chartaceae, latissime ovatae vel latissime ellipticae, nitidae, ad 7 mm longae, pallido brunneae; bractae intermediae late ellipticae, ad 15 mm longae, ad apicem malvinae; bractae intimae: unguis late obovatus, stereomate oblongo, vix incrassato, nervo singulari ad apicem extenso; lamina petaloidea, anguste elliptica, ad 20 mm longa, pallido cremea vel ad basim atropurpurea. Receptaculum discoideum, margine areolae pilosa aliter glabrum. Flosculi numerosi, bisexuales vel flosculis intimis masculinis. Corolla: tubus anguste cylindraceus, c. 2 mm longus; faux valde zygomorpha anguste turbinata, c. 1 mm longa; lobi 5, c. 1.5 mm longi, lobis tribus abaxialis recurvis, cremeis, profunde fissa. intra laevibus, lobis duobus adaxiali erectis, ad apicem connatis, rubiginosis, intra papillosis, nervis corollae ad apicem lobulorum extensis. Antherarum appendix sterilis late elliptica, obtusa, 0.2 mm longa; cellulae oblongae, parietibus tenuibus, cellulis parietibus incrassatis immixtis; cellulae marginales manifeste discretae. Anthracarum caudae filamentosae, debiles. Styli apex truncatus, nervo prominenti ad apicem extenso. Achenium compressum turbinatum, c. 2.5 mm longum, facie abaxiali sericeum, adaxiali hirsutum; carpophorum absens; pericarpium chartaceum; testa membranacea ad pericarpium adnata, nervo in positione medio cingenti. Pappi setae corollam leviter excedentes; in parte inferiore persistentes, anguste ellipticae; in parte superiore caducae, filamentosae, apice versus plumosae, ad extremum penicillatae ciliis clavatis ornatis, aliter denticulatae.

Typus: Western Australia, 6.5 km east of the turnoff to Useless Loop; abundant on flats, dominating a stony clay depression with *Acacia tetragonophylla* and *Acacia* sp., 16.viii.1986, R.C. Chinnock 6760 (holo: AD; iso: K, MEL, PERTH).

Erect annual to 25 cm high, branching at base; major axes slender, solitary or several, simple, woolly near apex otherwise glabrous, glandular hairs absent. Leaves cauline, alternate, entire, linear to narrow-obovate, acute to obtuse, to 30 mm long, absent towards apex of stem. Capitula solitary, terminal to stems. Involucre hemispherical, c. 6 mm high. Bracts multiseriate, scarious or papery, glabrous; outer bracts scarious, very broadly ovate or broadly elliptic, to 7 mm long, pale brown; intermediate bracts broad-elliptic, to 15 mm long, pale brown with mauve apex; inner bracts: claw broad-obovate, stereome broad-oblong, scarcely thickened, with a single nerve extending to apex, lamina petaloid, narrow-elliptic, to 20 mm long, pale cream, often with a dark purple band at base. Receptacle disc-shaped, c. 5 mm broad, pilose on margin of areolae otherwise glabrous. Florets numerous, bisexual or the inner ones male. Corolla almost glabrous: tube cylindrical, c. 2 mm long; throat narrow-turbinate, strongly zygomorphic, c. 1 mm long; lobes 5, c. 1.5 mm long, the three abaxial lobes deeply divided, recurved, cream coloured, smooth within, the 2 adaxial lobes fused to near apex, dark reddish brown, papillose within; vascular strands extending to tip of lobes. Anther appendage broad-elliptic, obtuse, 0.2 mm long; cells oblong, thick-walled cells interspersed among thin-walled cells; marginal cell row clearly demarcated; anther tails filamentous and weak. Style tip truncate, the vascular strand stout and extending to apex. Achene compressed turbinate, c. 2.5 mm long, silky on abaxial face and hirsute on adaxial face; carpopodium absent; pericarp papery; testa membranous, fused to pericarp, the vascular strand encircling seed in medial position. Pappus bristles slightly exceeding corolla; lower half narrow elliptic, barbellate and persistent; upper half filamentous and deciduous, towards apex plumose with the terminal cilia penicillate and clavate, towards base barbellate.

Distribution. Western Australia, from the south end of Hamelin Pool, Shark Bay, eastwards to the North West Coastal Highway.

Specimens seen. WESTERN AUSTRALIA: 493 mile peg North West Highway, T.E.H. Aplin 3282 (PERTH); 5 miles west of Hamelin Station, J.W. Green 1444 (PERTH); 22 km west of Overlander Roadhouse on Denham road, N.S. Lander 1322 (PERTH); 28 km NNW of Overlander Roadhouse, North West Coastal Highway, E.N.S. Jackson 3121 (AD *pro parte*); 3 km from Overlander Roadhouse, P.S. Short 422 (AD *pro parte*); 20 km north of Billabong Roadhouse, P.S. Short 2453 (PERTH).

Habitat. Usually found in red sand over loam.

This species appears to be related to *Rhodanthe chlorocephala*. It superficially very closely resembles *R. chlorocephala* subsp. *splendida* which grows intermixed with *R. cremea* near Shark Bay and some herbarium collections consist of material of both species. *Rhodanthe chlorocephala* may be distinguished by the spherical glandular hairs on leaves and stems, the absence of woolly hairs, the regular corollas, and the evenly silky achenes.

Those variants of *Cephalopterum drummondii* and of *R. chlorocephala* subsp. *splendida* that have large white involucre bracts often resemble *R. cremea* in having a dark purple band at the base of these bracts. Since the three species grow together in the Hamelin Pool region it is likely that they attract the same pollen vectors.

The epithet *cremea* (cream coloured) refers to the colour of the inner involucre bracts.



Figure 2. *Rhodanthe cremea*. A - Habit. B - Capitulum. C - Corolla opened out. D - Bisexual floret. E - Corolla. F - Male floret. G - Receptacle. H - Pappus bristles. I - Style branches. J - Anther. K - Leaf. L - Leaf hairs. M - Outer and inner involucre bracts. N - Achene. O - T.S. achene. From J.W. Green 1444.

Rhodanthe diffusa (Cunn. ex DC.) Paul G. Wilson, comb. nov.

Helipterum diffusum A.Cunn. ex DC., Prod. 6:216(1838). Type: Forest grounds at the base of Peels range, Interior of New South Wales, June 1817, A. Cunningham (holo: G-DC photo seen).

Rhodanthe diffusa (DC.) Paul G. Wilson subsp. **diffusa**

This taxon represents the yellow-rayed variant.

Rhodanthe diffusa subsp. **leucactina** (F. Muell.) Paul G. Wilson, comb. nov.

Helipterum polygalifolium var. *leucactinum* F. Muell., Fragm. 10:107(1877). Type citation: 'Darling's River (Andrae), Warrego (Bailey), Curruwillugh (Dalton), Ballandool (Looker).' *Lectotype* (here chosen): Warrego district, F.M. Bailey (MEL 110257).

The taxon represents the white-rayed variant.

Note. The only substantial difference between the two subspecies is in the colour of the radiant involucre bracts, however the stems of northern variant of subsp. *leucactina* are sometimes branched above and have a minutely glandular hispidulous indumentum beneath the capitula rather than cottony. The typical subspecies is found in south-eastern New South Wales between Hillston and Narrandera while the subsp. *leucactina* is found further north from Nyngan north to south-eastern Queensland. Both subspecies have been confused with other species: the yellow subspecies was synonymized by Bentham (1867) (and subsequently confused in some herbaria) with *Helipterum polygalifolium*, while the white has been confused with *H. anthemoides*. *Rhodanthe polygalifolia* may be readily distinguished by being glabrous apart from the minute globular glands on the adaxial surface of the leaves (in *R. diffusa* the leaves bear glands and multiseptate hairs on the stems and on both surfaces of the leaves), while *R. anthemoides* may be distinguished by being a perennial, by the generally thicker leaves and embedded globular glands, and by the reddish brown linear midrib on the claws of the involucre bracts.

Rhodanthe fuscescens (Turcz.) Paul G. Wilson, comb. nov.

Helipterum fuscescens Turcz., Bull. Soc. Imp. Naturalistes Moscou 24/2:80(1851). - *Podotheca fuscescens* (Turcz.) Benth., Fl. Austral. 3:602(1867). - *Podosperma fuscescens* (Turcz.) F. Muell., Fragm. 12:22(1882). - *Argyrocome fuscescens* (Turcz.) Kuntze, Revis. Gen. Pl. 1:309(1891). Type: Western Australia, J. Drummond 5th coll. (suppl.) n.64 (holo: KW photo seen; iso: K, MEL 110215, PERTH).

Acroclinium phyllocephalum A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:271(1852). Type citation: 'South-west Australia, Drummond (received in 1850)' *n.v.*

This species is very similar to *Rhodanthe oppositifolia* from which it differs in having leaves that subtend the capitula and in having very short and brown involucre bracts. *Rhodanthe fuscescens* is known only from the Drummond types and from E. Pritzel 695. The Drummond sheets on which the names *H. fuscescens* and *A. phyllocephalum* were based are probably duplicates of the same collection (Short 1983); both sheets lack locality data. The collection Pritzel 695, dated 1901, is almost identical to the Drummond; it came from near Cranbrook in south-west Western Australia which is about 400 km from the nearest locality for *R. oppositifolia*.

***Rhodanthe gossypina* Paul G. Wilson, sp. nov.**

Herba annua erecta gossypina. Folia caulina, alterna, linearia vel anguste oblonga, acuminata, 2-4 cm longa. Capitula homogama in corymbis terminalibus ordinata. Involucrum turbinatum, c. 4 mm altum, radians; bracteae c. 3-seriatae; bracteae intermediae ellipticae c. 5 mm longae, hyalinae, lanato ciliatae, ad apice brunneolae, stereomate anguste oblongo, viridi, in parte superiore gossypino; bracteae intimae: unguis late obovatus c. 4 mm longus, hyalinis, gossypino ciliatus, stereomate anguste oblongo, gossypino, in parte superiore pilis resinosis rubiginosis ornatum; lamina patula, ovata, c. 4 mm longa, alba. Receptaculum conicum, c. 0.7 mm diam. Flosculi c. 15, bisexuales. Corolla c. 3 mm longa, 5-lobata; lobi inaequales, oblongo-triangulares, intra laeves, lobo abaxiali c. 1.5 mm longo, ceteris c. 1 mm longis; nervi corollae in tubo terminantes. Antherae: appendix sterilis elliptica c. 0.4 mm longa, parietibus cellularum nec incrassatis; caudis filamentis, debiles. Styli apex \pm truncatus. Achenium ellipsoideum, 1.5-3 mm longum, subtiliter pilosum; carpophorum annulare; pericarpium chartaceum, translucens; testa aliquantum coriacea, brunnea, ad pericarpium adnata, nervo c. 2/3 cingenti. Pappus persistens; setae lineari-acuminatae corollam aequantes, omnino pilosae.

Typus: Queensland: Mitchell district, 36.9 km SE of Winton on Longreach road, 19 Sept. 1984, R.J. Chinnock 6106 (holo: AD; iso: PERTH).

Annual erect cottony herb; stems slender, single or branching at base, to 20 cm high. Leaves cauline, alternate, linear to narrow-oblong, acuminate, 2-4 cm long, 1-5 mm wide. Capitula homogamous, in terminal corymbs. Involucre turbinate, c. 4 mm high, radiant; bracts c. 3-seriate; intermediate bracts elliptic, c. 5 mm long, hyaline, woolly ciliate, brown-tinged towards apex, with narrow-oblong green stereome cottony in upper half, c. 2 mm long; innermost bracts: claw broad-obovate, c. 3.7 mm long, 2 mm wide, hyaline, cottony ciliate, stereome narrow-oblong extending to near apex, cottony and with dark reddish brown resinous hairs in upper half; lamina spreading, ovate, c. 4 mm long, 2 mm wide, white. Receptacle conical, c. 0.7 mm diameter. Florets c. 15, all bisexual. Corolla c. 3 mm long, narrow-cylindrical below, somewhat broader above, sparsely puberulous in lower half, yellow, vascular strands terminating well below lobes; lobes oblong-triangular, 0.5-1 mm long, not papillose within, glabrous outside, the abaxial lobe more deeply divided (up to 1.5 mm long). Anthers: appendage elliptic, c. 0.4 mm long, smooth, cells not thickened, very pale brown or the marginal ones clear; tails filamentous, weak. Style apex \pm truncate to slightly rounded, shortly papillose. Achene ellipsoidal, 1.5-3 mm long, pilose with fine very pale brown hairs; carpopodium a short glabrous ring; pericarp translucent, papery, very pale brown; testa somewhat leathery, brown, fused to pericarp when mature; vascular strand of testa extending c. 2/3 around seed in medial position. Pappus bristles linear-acuminate, \pm equal to corolla, united in a ring at base, persistent, pilose throughout, the terminal cilia somewhat thicker and rounded at apex.

Distribution. Southeastern Northern Territory, southwestern Queensland, extreme northeastern South Australia and northwestern New South Wales.

Specimens examined (selection only). QUEENSLAND: 100 km WNW of Charleville, C. Sandercoe 369 (BRI); Near Windorah, S.T. Blake 12079 (BRI).

NEW SOUTH WALES: 17.5 km from Louth on Telpa road, C.W.E. Moore 7794 (CANB).

SOUTH AUSTRALIA: Kudriemitchie Waterhole, L.D. Williams 8156 (AD).

NORTHERN TERRITORY: 7.5 mi N of Tobermorey homestead, G. Chippendale (NT 2961).

Habitat. In open situations on heavy soil that is frequently subject to flooding.

Flowering time. June to September.

This species is similar to *Rhodanthe corymbiflora* and *R. microglossa* with which two species it has been confused in herbaria. It differs from the former in having a smaller involucre with the bract-lamina about half as long, and in the possession of dark resinous hairs on the stereome of the inner bracts. From the latter it differs in having a more open inflorescence, dark resinous hairs on the inner bracts, much longer radiating laminae, and in having a smooth throat to the corolla.

Rhodanthe gossypina was recognised as a distinct taxon by C.T. White (herb. BRI) who evidently intended to describe it as a variety of *Helipterum corymbiflorum* but never did so (R.W. Johnson, pers. comm.).

The solitary collection from New South Wales, cited above, comes from a site geographically isolated from the other locations. It is morphologically distinct for the stereomes of the inner involucre bracts do not have glandular hairs and the lobes of the corolla are equal in length. For these reasons it may be found to represent a distinct species.

The specific epithet refers to the cottony indumentum that covers the plant.

***Rhodanthe humboldtiana* (Gaudich.) Paul G. Wilson comb. nov.**

Helichrysum humboldtianum Gaudich. in Freyc., Voy. Uranie 465(1830) t.88(1829). - *Helipterum humboldtianum* (Gaudich.) DC., Prod. 6:216(1838). - *Schoenia humboldtiana* (Gaudich.) Walpers, Repert. Bot. Syst. 6:244(1846). - *Pteropogon humboldtianus* (Gaudich.) F. Muell., Linnaea 25:415(1853). - *Argyrocome humboldtiana* (Gaudich.) Kuntze, Revis. Gen. Pl. 1:309(1891). - *Roccardia humboldtiana* (Gaudich.) Voss, Vilm. Blumengärtn. 3rd edn, 1:532(1896). Type citation: 'In Novae-Hollandiae ora occidentale (baie des Chiens-Marins)', 1830, *Gaudichaud*. *Lectotype* (here chosen): P photo seen; islecto: G-DC photo seen.

Helipterum sandfordii Hook., Bot. Mag. t.5350(1862). Type: *J. Drummond* 160, between Moore and Murchison rivers; 1860, *Burgess*; cult. Thompson from seeds from Major Sandford, W.A. *Isosyntypes*: *J. Drummond* 160 (MEL 109493, NSW).

Helipterum largiflorens F. Muell., Fragm. 3:135(1863). Type citation: 'Ad sinum Champion bay et flumen Murchison. Walcott et Oldfield.' *Lectotype* (here chosen): Champion Bay, A. *Oldfield* (MEL 109501).

Helipterum clementii Domin, Biblioth. Bot. 89:667(1929). Type citation: 'Nordwest-Australien: zwischen Ashburton- und De Gray River, E. Clement'. Type *n.v.*

***Rhodanthe microglossa* (Maiden & E. Betcher) Paul G. Wilson, comb. nov.**

Helipterum microglossum Maiden & E. Betcher, Proc. Linn. Soc. New South Wales 22:151(1897). Type: Tarella, New South Wales, Aug. 1887, W. *Bäuerlen* 131 (holo: NSW 181467).

Helipterum corymbiflorum var. *microglossa* F. Muell. ex Benth., Fl. Austral. 3:647(1867). - *H. microglossa* (Benth.) Tate, Trans & Proc. Roy. Soc. South Australia 22:121(1898). *Lectotype* (here chosen): Goyinga mountains, 6 & 7 Nov. 1860, *Victorian Expedition* (MEL 110255).

Note. It was unclear from the paper by Maiden and Betcher whether they intended to describe a new species based on the Bäuerlen collection or whether they intended to make a new combination based on *Helipterum corymbiflorum* var. *microglossa*; I have assumed the former intention, partly because the epithet was changed from a substantive to an adjective and partly because the format used was the same as that for other new species described in the paper. Ralph Tate (1898 *loc.cit.*) claimed to have published the species combination in the Trans. & Proc. Roy. Soc. South Australia 6:104(1883), however, in that paper the name *Helipterum microglossa* was not validly published since it appeared without citation of either author or basionym, and without a description.

Rhodanthe oppositifolia (S. Moore) Paul G. Wilson, comb. nov.

Helipterum oppositifolium S. Moore, J. Bot. 35:165(1897). Type: Near Coolgardie, Sept.1895, S.Moore (holo: BM; iso: MEL 110309).

Griffithia helipteroides J. Black, Trans. & Proc. Roy. Soc. South Australia 37:122(1913). Type citation: 'Gawler Ranges, Eyre Peninsula (S.A.White, September, 1912)' (holo: AD; iso: K).

subsp. ***oppositifolia***

subsp. ***ornata*** Paul G. Wilson, subsp. nov.

Folia lineari-acuminata, c. 30 x 2 mm. Involucrum hemisphericum, c. 6 mm altum; lamina bractearum interiorum elliptica, 10 mm longa, flava.

Typus: Western Australia: 3 km NW of Tamala Homestead, 26° 40' S, 113° 42' E, at foot of calcarete ridge on edge of samphire flat, powdery white clay loam on sheet calcarete, 25 August 1991, S.D. Hopper 8112 (holo: PERTH; iso: CANB, K, MEL, S).

Leaves linear-acuminate, c. 30 x 2 mm. Involucre hemispherical, c. 6 mm high; inner bracts with a prominent elliptic yellow lamina c. 10 mm long.

Distribution. Only known from the southern margin of Freycinet Estuary in Tamala station, Western Australia. Found growing on calcarete rises on edge of saline flats.

Additional specimens seen. WESTERN AUSTRALIA: 13.5 km W of Tamala homestead road on Useless Loop road, S.D. Hopper 8113 (PERTH); Tamala Station, 20 July 1988, Ph. Morat 8212 (P).

This subspecies differs from the typical in having larger capitula and much larger lamina to the inner involucre bracts which in the typical subspecies are only 2-3 mm long. Subsp. *oppositifolia* is also found in the Shark Bay region but evidently not in association with subsp. *ornata*.

Rhodanthe polygalifolia (A.Cunn. ex DC.) Paul G. Wilson, comb. nov.

Helipterum polygalifolium A.Cunn. ex DC., Prod. 6:216(1838). - *Argyrocome polygalifolia* (DC.) Kuntze, Revis. Gen. Pl. 1:309(1891). Type: Molle's Plains, Lachlan river, New South Wales, 1817, A. Cunningham (holo: G-DC photo seen).

Rhodanthe propinqua (W. Fitzg.) Paul G. Wilson, comb. nov.

Helipterum propinquum W. Fitzg., J. W. Austral. Nat. Hist. Soc. No. 1:24 (May 1904). *Lectotype* (here chosen): Nannine, Western Australia, Sept. 1903, *W.V. Fitzgerald* (NSW 181422; isolecto: NSW 181423, PERTH).

Rhodanthe pygmaea (DC.) Paul G. Wilson, comb. nov.

Pteropogon pygmaeus DC., Prod. 6:245 (1838). - *Pteropogon australis* Nees, Linnaea 16:223 (1842) *nom. illeg.*, based on above. - *Helipterum pygmaeum* (DC.) F. Muell., Rep. Babbage's Exped. 14 (1859); Benth., Fl. Austral. 3:647 (1867). *Type*: Molle's plains, Lachlan river, Interior west from Port Jackson, Long. 145°E, 'a remarkable pigmy plant', July 1817, A. *Cunningham* 101 (holo: G-DC photo seen).

Pteropogon drummondii A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:267 (1852). - *Helipterum pygmaeum* var. *occidentale* Benth., Fl. Austral. 3:647 (1867). - *Helipterum pygmaeum* var. *drummondii* (A. Gray) Ostenfeld, Dansk Bot. Ark. 3:142 (1921) *nom. illeg.* - *Helipterum drummondii* (A. Gray) Ostenfeld, *l.c.* *Type*: Western Australia, 1849, J. *Drummond* (holo: K).

Pteropogon intermedius F. Muell., Linnaea 25:411 (1853). *Type citation*: 'In collibus graminosis montem Rufus versus, ante Torrens tenuis, ubertim rarus.' *Lectotype* (here chosen): Ad rivum Broughton, Oct. 1851, F. *Mueller* (MEL 604821).

Rhodanthe rubella (A. Gray) Paul G. Wilson, comb. nov.

Acroclinium rubellum A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:271 (1852). - *Helipterum rubellum* (A. Gray) Benth., Fl. Austral. 3:641 (1867). - *Argyrocome rubella* (A. Gray) Kuntze, Revis. Gen. Pl. 1:309 (1891). - *Roccardia rubella* (A. Gray) Voss, Vilm. Blumengärtn. 3rd edn, 1:530 (1896). *Type citation*: 'Between Swan River and King George Sound, *Drummond*.' *Lectotype* (here chosen): J. *Drummond* 347 (K, photo seen).

Rhodanthe rufescens Paul G. Wilson, sp. nov.

Herba annua decumbens, sparse et minute glanduloso-puberula; axes majores numerosi ad 10 cm longi. Folia caulina alterna sessilia, anguste oblonga, ad 10 mm longa, integra, obtusa. Capitula homogama, ad ramulos terminalia posita, nec radiantia. Involuerum breviter cylindraceum, 4-5 mm altum. Bracteae c. 3-seriatae, scariosae, supra stereoma sparsissime et minute glanduloso-puberulae aliter glabrae; bracteae exteriores ovatae, c. 2 mm longae, stramineae; bracteae interiores obovatae, ad 5 mm longae, ad apicem rotundatae, versus basim stramineae, versus apicem violaceae vel margine apicali hyalino. Receptaculum rotundatum c. 0.7 mm diam., glabrum. Flosculi c. 7, bisexuales, actinomorphi. Corolla c. 3.5 mm longa, infra medium cylindracea, supra medium anguste cupulata; lobi 5, triangulares, c. 1 mm longi, intra ad basim papilloso; nervi ad basim loborum extensi. Antherae loculis c. 1 mm longis; appendix c. 0.3 mm longus ad apicem rotundatus, cellulis oblongis nec incrassatis; caudae filamentae, debiles. Styli apex truncatus, nervo ad basim apicis extenso. Achenium (in statu immaturo) sericeum, carpophoro absenti, pericarpio tenui, translucido, testa tenuiter coriacea. Pappi setae lineares acuminatae, c. 2 mm longae, omnino plumosae, ciliis omnino acuminatis.

Typus: Queensland, Gregory South District, Noccundra, about 130 km west-north-west of Thargomindah, 'herbage', 11 Aug. 1987, *P. Warhurst s.n.* (holo: BRI 410267).

Annual (? decumbent) herb with many somewhat wiry stems to 10 cm long arising from base. Branches and leaves sparsely covered with minute sessile or shortly stipitate globular glands, otherwise glabrous. Leaves cauline, alternate, sessile, narrow-oblong, to 10 mm long, 1–2 mm wide, entire, obtuse. Capitula homogamous, terminal to slender lateral and main branches, sometimes subtended by a foliaceous bract. Involucre shortly cylindrical, 4–5 mm high, not radiant; bracts scarious, glabrous apart from a few minute glandular hairs on stereome, c. 3-seriate; outer bracts ovate c. 2 mm long, straw-coloured, glabrous; inner bracts obovate, to 5 mm long, rounded at apex, straw-coloured towards base, violet brown towards apex or with the tip hyaline, stereome oblong, 2/3 length of bract, flat, pale green. Receptacle rounded, c. 0.7 mm diameter, glabrous. Florets c. 7, all apparently bisexual. Corolla tube c. 3.5 mm high, cylindrical below, narrowly cup-shaped above, very sparsely puberulous, yellow; lobes 5, ovate, triangular, c. 1 mm long, papillose within in a broad ring around base of lobes; vascular strands extending to base of lobes. Stamens: anther appendage c. 0.3 mm long rounded at apex, cells oblong, not thickened; anther tails weak and filamentous. Style tip truncate, papillose; vascular strand prominent and extending to base of tip. Achene (not seen mature) silky villous all over; carpopodium absent; pericarp thin, translucent; testa thinly coriaceous, with crystals. Pappus bristles linear-acuminate, c. 2 mm long at anthesis, plumose to tip, terminal cilia not thickened.

Distribution. Only known from the type locality in south-west Queensland.

The specific epithet refers to the reddish colour of the terminal portion of the inner involucreal bracts.

Rhodanthe stricta (Lindley) Paul G. Wilson, comb. nov.

Xyridanthe stricta Lindley, Sketch Veg. Swan Riv. Col. 23(1839). - *Helipterum strictum* (Lindley) Benth., Fl. Austral. 3:646(1867), *Type*: Swan River, 1839, *J. Drummond* (holo: CGE photo seen).

Pteropogon platyphyllus F. Muell., Linnaca 25:413(1853). *Type citation*: 'Ad margines rupestres rivulorum ad Cudnaka rariusve ibidem in planitiibus sterilibus.' *Lectotype* (here chosen): 'Ad marginis rupestris rivi Cudnaka', Oct. 1851, *F. Mueller* (lecto: MEL 110685; isolecto: MEL 604829).

Helipterum strictum var. *stenocephala* S. Moore, J. Linn. Soc. 34:200(1899). *Type*: Near Coolgardie, August 1895, *S. Moore* (holo: BM photo seen).

4. *Rhodanthe* sect. *Achyroclinoide*s (A. Gray) Paul G. Wilson, comb. nov.

Pteropogon sect. *Achyroclinoide*s A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:268(1852). *Lectotype* (here designated): *Pteropogon corymbosus* A. Gray.

[*Cassinia* sect. *Cassiniola* F. Muell., Fragm. 3:139(1863) *nomen sub Cassinia cuprea* F. Muell. (= *Pteropogon polycephalus* A. Gray)].

Plant variously pubescent to sub-glabrous, without sessile glands on leaves. Style apex truncate. Achene small, 1–1.5 mm long, moderately to sparsely short hirsute; carpopodium annular, glabrous;

pericarp crustaceous, thin, brown, the radial cell walls thickened; testa membranous, free or fused to pericarp. Pappus caducous.

Note. Asa Gray (1852) included *Pteropogon polycephalus* A. Gray, *P. corymbosus* A. Gray and *P. laevis* A. Gray in his section *Achyroclinoideae*. These three species are all recognised here as being members of this section.

***Rhodanthe ascendens* Paul G. Wilson, sp. nov.**

Herba annua ascendens ad 10 cm alta, modice lanosa. Folia caulina, alterna, anguste obovata, plana, 10-15 mm longa, c. 2 mm lata, sessilia. Inflorescentia corymbiformia, compacta. Capitula homogama, breviter pedunculata. Involucrum cupulatum c. 5 mm altum, 2.5 mm latum, nec radians; bracteae glumaceae, 3-4-seriatae, nitidae, bracteis intermediis interioribusque ellipticis, 4-5 mm longis, ad apicem rotundatis, ad basim sparse ciliatis aliter glabris. Receptaculum convexum, glabrum, c. 1 mm latum, bracteis receptaculi absentibus. Flosculi c. 20, bisexuales, actinomorphi. Corolla c. 3 mm longa, glabra, nervis ad apicem tubi extensis; lobi deltoidici, c. 0.5 mm longi, lobis tribus parte interiore ad basim papillois, ceteris glabris. Antherae c. 1 mm longae; apex anguste ovatus obtusus, c. 0.3 mm longus, cellulis anguste oblongis; caudae filamentae, debiles. Styli apex truncatus, nervo prominenti ad apicem extenso. Achenium, in statu immaturo, anguste cylindraceum, 1 mm longum, breviter hirtellum; carpophorum annulare, glabrum; pericarpium tenue, translucens; testa membranacea. Pappus corollam aequans, in statu integro caducae; setae c. 15, filiformes, ad basem breviter connatae, barbellatae.

Typus: Western Australia, Gascoyne Junction; florets yellow; roadside verge, clay soil; 20 Aug. 1986, P.S. Short 2531 (holo: PERTH; iso: MEL *n.v.*).

Annual ascendent herb to 10 cm high, branching at base, moderately and loosely woolly. Leaves sessile, alternate, cauline, narrow obovate, obtuse, flat, 10 - 15 mm long, c. 2 mm wide. Inflorescence corymbiform, compact. Capitula homogamous, very shortly pedunculate. Involucre cup-shaped, c. 5 mm high, not radiant; bracts glumaceous, 3-4-seriate, glossy, intermediate and inner bracts elliptic, to 4.5 mm long, rounded at apex, sparsely ciliate at base otherwise glabrous. Receptacle convex, glabrous, without receptacular bracts, c. 1 mm diameter. Florets c. 20, bisexual, actinomorphic. Corolla c. 3 mm long, yellow, narrow-tubular in lower half, narrow-turbinate above, glabrous, vascular strands extending to apex of tube; lobes broad-triangular, c. 0.5 mm long, three of the lobes papillose within at base the others glabrous; cells of throat strongly undulate. Stamens: anther loculi c. 1 mm long; tip oblong-ovate, obtuse, c. 0.3 mm long, the cells narrow-oblong; tails filamentous, weak. Style arms truncate, papillose, the vascular strand prominent and extending to base of tip. Achene (in immature state) narrow-cylindrical, 1.0 mm long, shortly hirtellous with duplex hairs c. 0.1 mm long, bifid at tip, myxogenic; carpopodium a narrow glabrous ring; pericarp thin and translucent, weak; testa membranous, free from pericarp, vascular strand extending to apex of seed; endosperm persistent and forming a sheath around the embryo. Pappus bristles c. 15, \pm equal to corolla, very shortly united in a ring at base, barbellate throughout, the terminal teeth rounded, caducous as a whole.

Distribution. Found only in the Carnarvon Botanical District (Beard 1980) near Gascoyne Junction, Western Australia.

Additional specimen examined. WESTERN AUSTRALIA: Middaly Station, 1989, D.C. Norbury 1 (PERTH).

Habitat. The type was found in clay soil on a roadside verge.

Rhodanthe ascendens is very similar to *R. nullarborensis* from which it differs most obviously in having broader leaves and larger capitula. In the details of the florets it differs in having barbellate (not shortly plumose) pappus bristles and in having three (not two) of the corolla lobes papillose at their base, but this latter character may be a variable one. The achene of *R. nullarborensis* has a thin crustaceous pericarp with lignified radial walls while in its immature state the pericarp of *R. ascendens* shows no sign of such thickening but this may develop later.

Rhodanthe condensata (F. Muell.) Paul G. Wilson, comb. nov.

Helipterum condensatum F. Muell., *Fragm.* 3:136(1863). - *Argyrocome condensata* (F. Muell.) Kuntze, *Revis. Gen. Pl.* 1:309(1891). *Type*: Murchison River, Western Australia, A. Oldfield (holo: MEL 110770).

Rhodanthe corymbosa (A. Gray) Paul G. Wilson, comb. nov.

Pteropogon corymbosus A. Gray, *Hooker's J. Bot. Kew Gard. Misc.* 4:268(1852). - *Helipterum corymbosum* (A. Gray) Benth., *Fl. Austral.* 3:649(1867). - *Argyrocome corymbosa* (A. Gray) Kuntze, *Revis. Gen. Pl.* 1:309(1891). *Type citation*: 'Swan river, Drummond. - Darling Range, South-west Australia, Collie.' *Isosyntype*: *J. Drummond* 364 (MEL 109605).

Helipterum album Ewart, J. & *Proc. Roy. Soc. New South Wales* 42:189(1909). *Type*: Wooroloo, Western Australia, 1906, *M. Koch* 1553 (?holo: NSW 181466; iso: PERTH).

Rhodanthe forrestii (F. Muell.) Paul G. Wilson, comb. nov.

Helipterum forrestii F. Muell., *S. Sci. Rec.* 2:273(1882). - *Argyrocome forrestii* (F. Muell.) Kuntze, *Revis. Gen. Pl.* 1:309(1891). *Type citation*: 'In the neighbourhood of the Gascoyne-River; J. Forrest.' *Lectotype* (here chosen): Gascoyne river, 1882, *J. Forrest* (lecto: MEL 50292; isolecto: K, MEL 50290, 50291, PERTH).

This species differs from *R. polycephala* in having the leaves narrowed at the base and not decurrent and in having the capitula turbinate and not narrow-cylindrical. Further collecting may show that *R. polycephala* is only a northern variant of *R. forrestii*.

Rhodanthe haigii (F. Muell.) Paul G. Wilson, comb. nov.

Helipterum haigii F. Muell., *Fragm.* 10:107(1877). - *Argyrocome haigii* (F. Muell.) Kuntze, *Revis. Gen. Pl.* 1:309(1891). *Type*: Eucla, *Richards* (holo: MEL 110217; iso: PERTH).

Helipterum mullinense S. Moore, *J. Linn. Soc. Bot.* 45:181(1920). *Type*: Mulline, *J.E.C. Maryon* (?iso: MEL 110310).

Note. This species is similar to *R. humboldtiana* with which it was confused by Black (1957) and Haegi (1986). Apart from the presence of larger rays to the involucre bracts, *R. humboldtiana* may be readily distinguished by its silky pilose achenes for in *R. haigii* the achenes are shortly hirsute. Only *R. haigii* occurs in South Australia while both species are found in Western Australia.

***Rhodanthe laevis* (A. Gray) Paul G. Wilson, comb. nov.**

Pteropogon laevis A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:269(1852). - *Helipterum laeve* (A. Gray) Benth., Fl. Austral. 3:649(1867). - *Argyrocome laevis* (A. Gray) Kuntze, Revis. Gen. Pl. 1:309(1891). Type: Swan River, 1843, J. Drummond 366 (or 356) (holo:K).

***Rhodanthe nullarborensis* Paul G. Wilson, sp. nov. (Figure 3)**

Herba annua ad 30 cm alta, modice lanosa, aromatica. Folia caulina, alterna, linearia, plana, 10-15 mm longa, 1-1.5 mm lata, sessilia. Inflorescentia corymbiformia, compacta. Capitula homogama, breviter pedunculata. Involucrum cylindraceum vel anguste turbinatum, 3-4 mm altum, nec radians; bracteae glumaceae, 3-4-seriatae, nitidae, bracteis intermediis interioribusque oblongis, 3-4 mm longis, ad apicem rotundatis, sparse ciliatis aliter glabris. Receptaculum convexum, glabrum, c. 0.4 mm latum, bracteis receptaculi absentibus. Flosculi c. 12, bisexuales, actinomorphi. Corolla c. 3 mm longa, fere glabra, nervis ad apicem tubi extensis; lobi deltoidei, c. 1 mm longi, lobis duobus parte inferiore ad basim papilloso, ceteris glabris. Antherae c. 1 mm longae; apex anguste ovatus obtusus, c. 0.3 mm longus, cellulis anguste oblongis; caudae filamentae, debiles. Styli apex truncatus, nervo prominenti ad apicem extenso. Achenium anguste obovoideum, 1 mm longum, breviter hirtellum; carpophorum annulare, glabrum; pericarpium tenuiter crustaceum, atro rubiginosum, parietibus radialibus cellularum incrassatis; testa diaphana, ad pericarpium adnata. Pappus corollam aequans, in statu integro caducae; setae c. 12, filiformae, ad basem breviter connatae, breviter plumosae.

Type: Forrest, Western Australia, 'heavily scented, flower heads yellow', 30 Aug. 1930, *E.R.L. Johnson* 75 (holo: PERTH; iso: AD, K, MEL).

Annual erect herb to 30 cm high, branching at base, moderately and loosely woolly, strongly scented. Leaves numerous, alternate, cauline, linear, flat, 10 - 15 mm long, 1 - 1.5 mm wide, sessile. Inflorescence corymbiform, compact. Capitula homogamous, very shortly pedunculate. Involucre cylindrical to narrow-turbinate, 3-4 mm high, not radiant; bracts glumaceous, 3-4-seriate, glossy, intermediate and inner bracts oblong, 3-4 mm long, rounded at apex, sparsely ciliate, otherwise glabrous. Receptacle convex, glabrous, without receptacular bracts, c. 0.4 mm diameter. Florets c. 12, bisexual, actinomorphic. Corolla c. 3 mm long, yellow, narrow-tubular in lower half, narrow-turbinate above, glabrous or rarely very sparsely glandular puberulous, vascular strands extending to apex of tube; lobes broad-triangular, c. 1 mm long, two of the lobes papillose within at base, the others glabrous. Stamens: anther loculi c. 1 mm long; tip narrow-ovate, obtuse, c. 0.3 mm long, the cells narrow-oblong; tails filamentous, weak. Style arms truncate, papillose, the vascular strand prominent and extending to base of tip. Achene narrow-obovoid, 1.0 mm long, shortly hirtellous with duplex hairs c. 0.07 mm long, minutely bifid at tip, myxogenic; carpodium a narrow glabrous ring; pericarp thinly crustaceous, dark reddish brown, radial cell walls thickened; testa extremely thin and fused to pericarp, the vascular strand extending to apex of seed; endosperm persistent and forming a sheath around the embryo. Pappus bristles c. 12, \pm equal to corolla, very shortly united in a ring at base, shortly plumose throughout, caducous as a whole.

Distribution. Found only in the Nullarbor Region of Western Australia.

Specimens examined (selection only). WESTERN AUSTRALIA: Kanowna, *T.E.H. Aplin* 5745 (PERTH); 30 km S of Rawlinna, *R.J. Chinnock* 11262 (AD); 70 mi NNW of Reid, *A.S. George* 8491

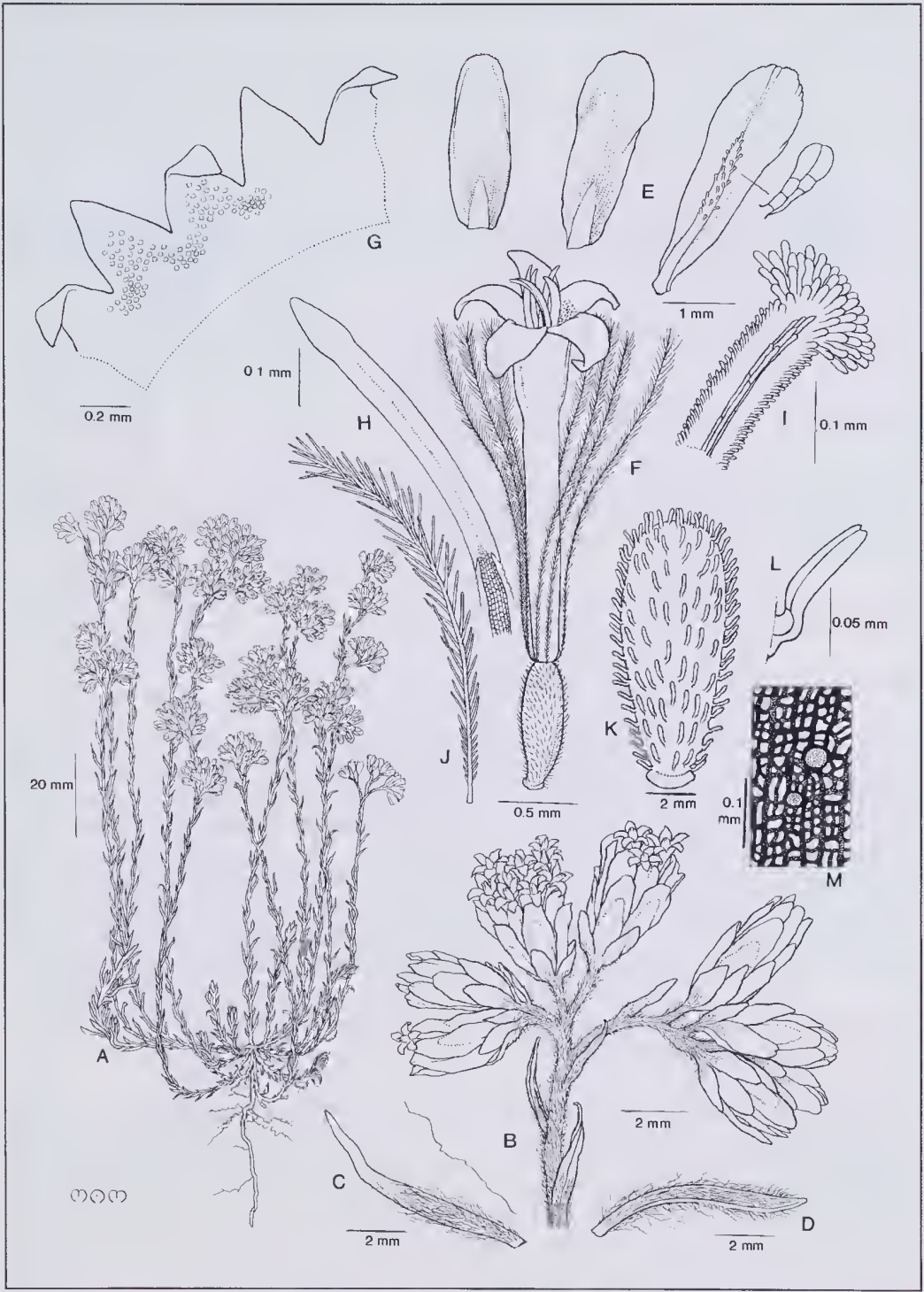


Figure 3. *Rhodanthe nullarborensis*. A - Habit. B - Terminal cluster of capitula. C - Leafy bract. D - Leaf. E - Outer, intermediate, and inner involucre bracts showing enlargement of glandular hair. F - Floret. G - Inner surface of apex of corolla indicating that only two lobes are papillose. H - Anther. I - Style apex. J - Pappus bristle. K - Achene. L - Duplex hair from achene. M - Surface of pericarp. From G.J. Keighery 7623.

(PERTH); 17 km NW of Koonjarra, *D.W. Goodall* 2511 (PERTH); 49 km NNE of Balladonia, *G.J. Keighery* 7623 (PERTH).

Habitat. In shallow open depressions (dongas) that have a layer of heavy soil over limestone.

Flowering time. July to October.

Rhodanthe nullarborensis resembles *H. tietkensis* with which it has been confused in herbaria. The latter species may be recognised by its larger leaves, its larger and more hairy capitula, and by the presence of receptacular bracts.

Johnson & Baird (1970) in referring to this species as *Helipterum tietkensis* state that it is heavily scented and that it forms dense colonies in the dongas.

Rhodanthe polycephala (A. Gray) Paul G. Wilson, comb. nov.

Pteropogon polycephalus A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:268(1852). - *Helipterum polycephalum* (A. Gray) Benth., Fl. Austral. 3:649(1867). - *Argyrocome polycephala* (A. Gray) Kuntze, Revis. Gen. Pl. 1:309(1891). Type citation: 'Swan river, Drummond', *n.v.*

Cassinia cuprea F. Muell., Fragm. 3:139(1863). *Lectotype* (here chosen): Near the Murchison, A. Oldfield (MEL 110308).

Rhodanthe psammophila Paul G. Wilson, sp. nov. (Figure 4)

Herba erecta ad 40 cm alta. Folia caulina alternata, anguste oblonda vel linearia, ad 6 cm longa, sessilia, parce decurrentia, lanata et minute stipitato-glandulosa. Capitula heterogama, sessilia, glomerata. Involucrum anguste turbinatum, c. 4 mm altum; bractae 4-6-seriatae, obovatae, 3-4 mm longae, apice albo, rotundato, margine eroso; unguis bractearum interiorum dense lanato-ciliatus. Flosculi semper quinque, uno fertili, quatuor masculinis. Corolla actinomorpha, sparse puberula; lobi intra papillosi. Achenium compresso-obovoideum, c. 2.5 mm longum, sparse et minute puberulum; carpophorum annulare; pericarpium tenuiter crustaceum; testa membranacea pericarpium adnata. Pappus achenii fertile tarde deciduus; setae c. 13, anguste lineares, acuminatae, c. 2.0 mm longae, sparse ciliatae pilis gracilibus acuminatis. Achenium bracteis interioribus consociatis deciduum.

Typus: Western Australia, 20 km north of Carnarvon, red sand dune, 25 September 1987, *Paul G. Wilson* 12604 (holo: PERTH; iso: AD, CANB, K, MEL, NSW, S).

Erect shortly woolly annual branching at and above base, to 40 cm high. Leaves cauline, alternate, narrow-oblong to linear, acuminate, to 6 cm long, sessile, slightly decurrent along the margins, woolly all over and with minute shortly stipitate reddish brown globular glands. Capitula heterogamous, sessile in dense clusters, these shortly stipitate forming subglobular heads on slender peduncles 1-3 cm long. Involucre narrow-turbinate, c. 4 mm high; bracts 6-seriate, obovate, 3-4 mm long, rounded at apex, hyaline in lower 2/3, white petaloid (with flat cells) and wrinkled above with erose margin; claw of inner bracts densely long woolly ciliate on margin, the wool enveloping the ovaries; sterome linear, hard, green, slightly shorter than claw, passing downwards into a very short hard stipe. Receptacle hemispherical, c. 3 mm high and wide, glabrous, smooth. Florets consistently 5 only one

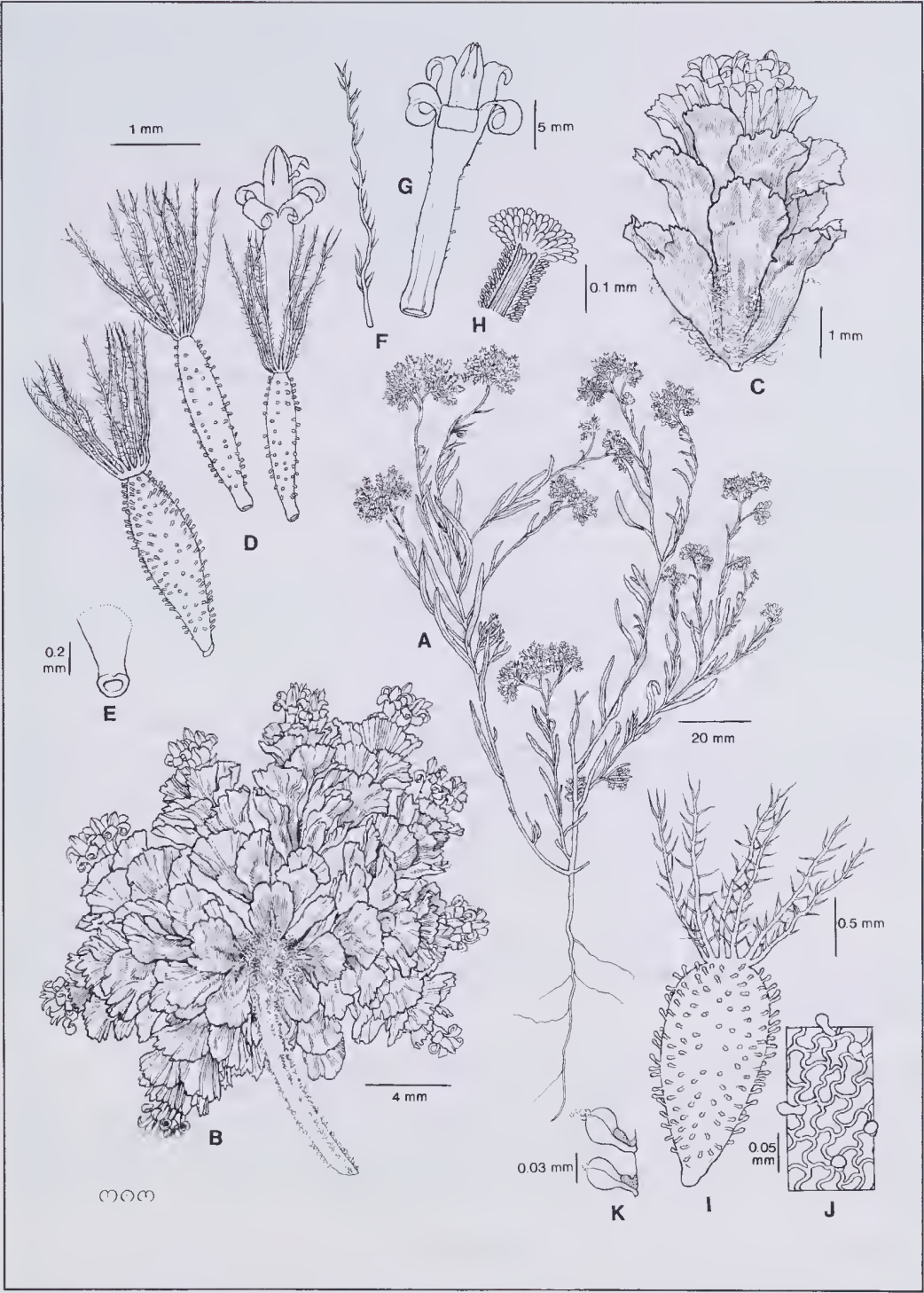


Figure 4. *Rhodanthe psammophila*. A - Habit. B - Cluster of capitula. C - Capitulum. D - Florets with and without corolla. E - Carpodium. F - Pappus bristle. G - Corolla. H - Style apex. I - Achene with pappus. J - Pericarp. K - Duplex myxogenic achenial hairs. From Paul G. Wilson 12604.

of which is bisexual, the others male. Corolla actinomorphic, yellow, tube c. 2.5 mm long, sparsely puberulous, narrow-tubular below, narrow-turbinate above; lobes oblong, obtuse, c. 0.5 mm long, the vascular strands extending to tips, all papillose within along entire length. Stamens: anther loculi c. 1 mm long; appendage ovate with narrow-oblong cells, the marginal ones smaller and equilateral; tails weak, slightly exceeding collar. Style apex truncate, penicillate, the vascular strand extending to apex. Achene compressed obovoid, c. 2.5 mm long, sparsely and minutely puberulous with blunt duplex hairs c. 0.06 mm long; carpodium a very short glabrous ring; pericarp thinly crustaceous, pale reddish brown, the cells of epidermis amoeboid, thickened on radial walls; testa membranous, vascular strand beneath a pericarpial strand and passing over apex of seed; endosperm persistent around embryo. Pappus (of fertile achene) tardily deciduous; bristles c. 13, narrow-linear, acuminate, c. 2.0 mm long, sparsely ciliate with slender acuminate hairs. Achene deciduous along with inner involucre bracts.

Distribution. Western Australia, near the coast between Carnarvon and Onslow, and inland to the Kennedy Range.

Specimens seen (selection only). WESTERN AUSTRALIA: Kennedy Range, *R.J. Cranfield* 1913 (PERTH); 10 mi S of Onslow, *A.S. George* 1150 (PERTH); southern margins of Lake McLeod, *P.S. Short* 2491 (MEL); 12 mi NW of Mt Sandiman, *B.L. Turner* 5401 (PERTH); Brown Range, *B.L. Turner* 5411 (PERTH).

Habitat. Grows only on sand dunes, both inland and coastal.

Chromosome number: $n = 5$ fide *B.L. Turner* (1970) as *Helipterum condensatum*.

Rhodanthe psammophila is superficially similar to *R. condensata* with which it has been confused in herbaria. The latter species may be distinguished by the absence of glandular hairs on the leaves, by the presence of 10-13 florets to a capitulum, and by the persistent pappus. The cells of the white lamina of the involucre bracts of *R. condensata* are raised at their tips giving it a slightly rough surface whereas in *R. psammophila* the lamina is smooth. *Rhodanthe condensata* is found from Shark Bay south to the Murchison River which is south of the distribution of *R. psammophila*.

The relationships of this species are unclear. In some ways, such as in the structure of the floret, it is similar to *Rhodanthe maryonii*, but it differs from that species in having a caducous achene and a 1-celled thick crustaceous pericarp (characters that, in this context, may be of little phylogenetic significance).

Rhodanthe tietkensis (F. Muell.) Paul G. Wilson, comb. nov.

Helipterum tietkensis F. Muell., *Fragm.*, 8:227 (1874). - *Argyrocome tietkensis* (F. Muell.) Kuntze, *Revis. Gen. Pl.* 1:309 (1891). *Type:* Between the Alberg and Mt Olga, 1873/4, *E. Giles* (holo: MEL 110506).

5. *Rhodanthe* sect. *Citrinae* Paul G. Wilson, sect. nov.

Herba annua erecta sparse lanosa, non glandulosa. Folia caulina alterna linearia vel anguste oblonga. Capitula homogama vel heterogama, terminalia. Involucrum radians; bracteae multiscratae, omnes chartaceae et petaloidae, exteriores sessiles, interiores unguiculatae; unguis oblongus vel

ellipticus, hyalinus, lanato-ciliatus, stereomate lineari applanato. Receptaculum glabrum, planum. Floreuli numerosi, homomorphi, actinomorphi, extra feminei vel bisexuales, intra bisexuales. Corolla infra tubulosa supra anguste turbinata, 4-5-loba, sparse pilosa; lobi glabri, intra laeves. Antherae: appendix anguste ovatus, tenuis, cellulis oblongis parietibus tenuibus; caudae filamentosae. Styli apex truncatus. Achenium anguste ellipsoideum, c. 1 mm longum, plerumque in rostrum glabrum attenuatum, breviter pilosum, pilis myxogeneis; pericarpium debile, cellulis epidermidis \pm cubicis, parietibus tenuibus; testa chartacea, pallido brunea ad pericarpio affixa, crystallis applanatis munitis. Pappi setae imo basi connatae, breviter plumosae vel denticulatae, caducae.

Holotypus: *Rhodanthe citrina* (Benth.) Paul G. Wilson

Annual erect herbs, sparsely woolly, not gland dotted. Leaves cauline, alternate, linear or narrow-oblong. Capitula homogamous or heterogamous, terminal. Involuere radiant; bracts multiseriate, all glumaceous and petaloid, outer sessile, the inner with an oblong or elliptic hyaline woolly ciliate claw. Receptacle glabrous, flat. Florets numerous, homomorphous, regular, the outer female or bisexual, the inner bisexual. Corolla tubular below, narrow-turbinate above, 4-5-lobed, sparsely pilose; lobes glabrous, smooth within. Anther appendix narrow-ovate, c. 0.2 mm long, thin, cells oblong with thin walls; tails filamentose. Style apex truncate. Achene narrow-ellipsoid, c. 1 mm long, frequently narrowed at apex into a beak; shortly pilose with duplex myxogenic hairs; pericarp with epidermis of thin-walled cubical cells, other tissue flattened and inconspicuous, vascular strands lateral (slightly oblique); testa papery, pale brown, adnate to pericarp, sparsely furnished with broad, flat crystals or these absent when mature, vascular strand ascending to apex and adjacent to a pericarpial strand. Pappus caducous; setae connate into a ring at base, shortly plumose or barbellate.

Rhodanthe citrina (Benth.) Paul G. Wilson, comb. nov.

Leptorhynchus citrinus Benth. in Endl. *et al.*, Enum. Pl. Hueg. 64(1837). *Waitzia citrina* (Benth.) Steetz in Lehm., Pl. Preiss. 1:454(1845). Type citation: 'Swan-River, (Hügel), n.v.

Waitzia brevirostris Steetz in Lehm., *op.cit.* 1:451(1845). Type: In arenosis sylvae supra urbiculam "Perth", 7 Oct.1839, *L. Preiss* 15. Lectotype (here chosen): MEL 1585201; isolecto: LD, MEL 1585197.

Waitzia sulphurea Steetz in Lehm., *op.cit.* 1:4553(1845). Lectotype (here chosen): In arenosis inter frutices prope urbiculam "Guildford", 14 Oct.1839, *L. Preiss* 7 (lecto: MEL 1585196; isolecto: LD).

Waitzia steetziana Lehm., *op.cit.* 1:454(1845). - *Waitzia tenella* Hook., Bot. Mag. t.5342(1862) *nom.illeg.* Type: In solo limoso sylvae prope praedium rusticum "Maddington", 31 Oct.1839, *L. Preiss* 6 (syntypes and isosyntypes: LD, MEL 1585194, 1585195, 1585198).

Waitzia dasycarpa Turcz., Bull. Soc. Imp. Naturalistes Moseou 24/2:77(1851). Type: Swan River Colony, J. Drummond 5th coll. no. 65 (holo: KW photo seen; iso: PERTH).

Helichrysum oldfieldii F.Muell., Fragm. 3:134-135(1863). Lectotype (here chosen): Murchison River, A. Oldfield (MEL 108299).

Distribution. Western Australia south of 22° lat., southern Northern Territory, northern South Australia, north western New South Wales.

Note: The genus *Waitzia*, as previously circumscribed, was an unnatural assemblage of species in the *Helipterum* complex that had in common a beak-like apex to the achene. In the strict sense (see Wilson 1992b) *Waitzia* contains species with the following characters: stipe-like claws to the involucre bracts, tooth-like papillae (that consist of 2 overtopping cells) on the achenes, and ellipsoid apices to the styles. In *Rhodanthe citrina* the inner involucre bracts have flattened scarious claws, the achenes have normal slender duplex hairs, and the style apices are truncate; it is thus distinct from *Waitzia* but similar to some species of *Rhodanthe* sect. *Achyroclinoides*. The section *Citrinae* differs from sect. *Achyroclinoides* principally in the nature of the involucre bracts which are all scarious and petaloid, the outer sessile and the inner stipitate on a broad hyaline ciliate claw; none of them is radiant. The appearance of the capitula is similar to that found in some species of *Chrysocephalum* (*Helichrysum* sect. *Chrysocephalum*), such as *Chrysocephalum apiculatum* (Labill.) Steetz, and the two species are sometimes confused.

In *Rhodanthe citrina* the rostrum to the achene is variable in length and in some specimens is completely absent; that organ, in any event, does not seem to be necessarily of generic significance since it merely represents an upwards extension of the pericarp.

It has been shown by Warcup (1990) that *Waitzia citrina* forms ectomycorrhizal associations whereas other *Rhodanthe* species that have been tested do not. It is possible that the seed with which Warcup worked was either *Hyalosperma cotula* (Benth.) Paul G. Wilson or *Chrysocephalum apiculatum*, both of these form ectomycorrhiza and both resemble *W. citrina*. No voucher material can be traced.

Two other species previously placed in *Waitzia*, i.e. *W. paniculata* (Steetz) Benth. and *W. conica* B. Turner, are also anomalous in that genus and are here transferred to *Pterochaeta* and *Haptotrichion* respectively.

6. *Rhodanthe* sect. *Synachyrum* (A. Gray) Paul G. Wilson, comb. nov.

Helipterum sect. *Synachyrum* A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:231(1852). *Type:* *Helipterum floribundum* DC.

[*Helipterum* sect. *Sericophorum* DC., Prod. 6:216(1838) *p.p. min.* excluding lectotype.]

Plants cottony. Intermediate involucre bracts with thick narrow-oblong stereome not extending into lamina; cottony. Corolla with vascular strands not extending to tips of lobes. Style apex truncate. Achene densely silky; carpodium absent; pericarp thinly coriaceous or papery; testa weak, free from pericarp, containing oblong imbricate crystals that form a complete cover to seed (see Figure 5). Pappus bristles narrow-oblong and sometimes partially united into a tube at base, caducous.

Rhodanthe floribunda (DC.) Paul G. Wilson, comb. nov. (Figure 5)

Helipterum floribundum DC., Prod. 6:217(1838). *Type:* Barren forests at the foot of Peel's Range, Interior of N.S.Wales, June 1817, A. Cunningham 107 (holo: G-DC photo seen).

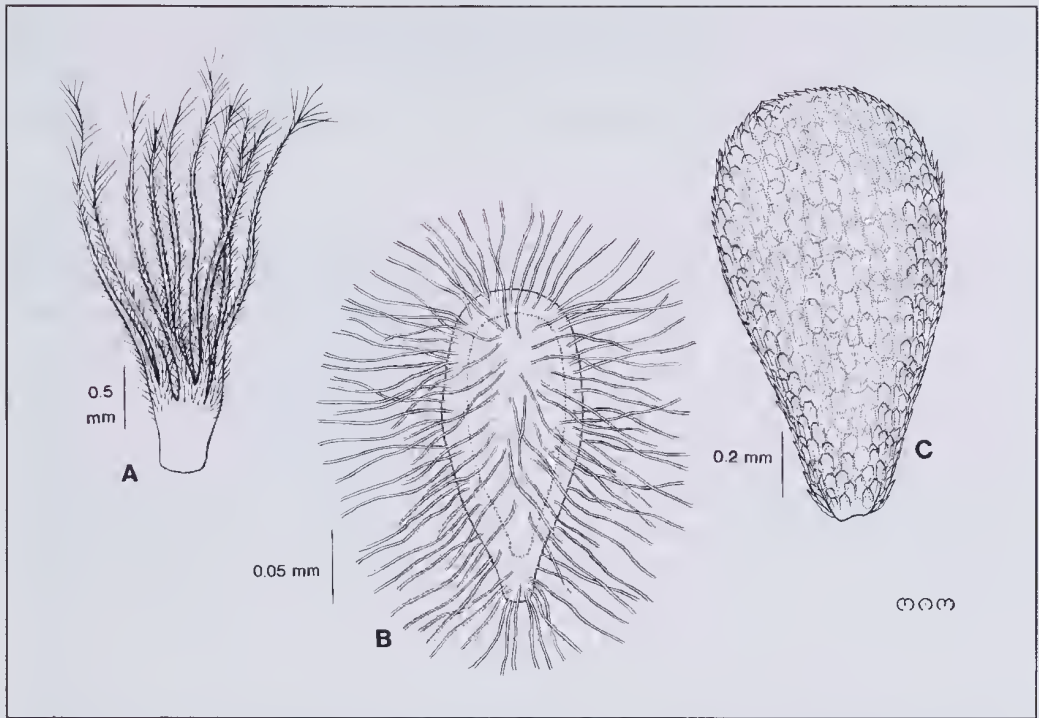


Figure 5. *Rhodanthe floribunda*. A - Pappus. B - Achene. C - Testa with imbricate scale-like crystals.

Helipterum chionolepis F. Muell., Linnaca 25:416(1853). Type citation: 'Juxta montes Flinders-range et Cudnaka locis sterilibus.' *Lectotype* (here chosen): MEL 110120 with labels 'Cudnaka' and 'Prope montis Flinders range, Oct.51' leg. F.Mueller; *syntype*: Cudnaka, F.Mueller (MEL 604828).

Helipterum cirratum Morrison, J.Bot. 50:168(1912). Type: Between Globe Hill and Uaroo, Ashburton River, 1 Oct. 1905, A.Morrison (? iso: PERTH).

Helipterum floribundum var. *tubulipappum* J. Black, Trans. & Proc. Roy. Soc. South Australia 36:23 t.2(1912). Type: Oodnadatta, Sept.1911, F.C. Staer per Mrs Mellor (holo: AD 98625088 p.p.).

***Rhodanthe sphaerocephala* Paul G. Wilson, sp. nov.**

Annua erecta ad 25 cm alta. Rami lanosi, omnino foliacei. Folia alterna sessilia, angustissimo oblonga, c. 10 mm longa, sparse lanosa. Capitula homogama, solitaria, terminalia, sphacroidea, c. 10 mm diam. Bracteae involucri multi-seriatae, aliquantum corrugatae, nitidae. Bracteae intermediae in ambito obovatae, c. 5 mm longae; unguis latissime oblongus, hyalinus; stereoma spatulatum, parte terminali incrassata et dense lanosa; lamina late elliptica, integra, straminea. Receptaculum conicum, tuberculatum. Flosculi numerosi, bisexuales, actinomorphi. Corolla c. 4 mm longa, glabra; lobi 5, anguste oblongi, c. 1.5 mm longi, intra lacves; nervi corollae ad apice tubi extensi. Antherae: appendix sterilis ovata, acuta, c. 0.6 mm longa, cellulis oblongis, parietibus nec incrassatis; caudis filamentis debiles. Styli apex truncatus, nervo prominenti ad basem apicis extenso. Achenium ellipsoideum c. 2 mm longum, dense sericeum, pilis in lobos inaequales terminantibus; pericarpum membranaceum, translucens; testa tenuiter coriacea, pallide brunea, cellulis crystallis oblongis

repletis. Pappi setae librae, caducae, in parte inferiore angusto ellipticae, breviter plumosae, in parte superiore filiformae, sparse plumosae, ad extremum plumoso-penicillatae.

Typus: Belele Station, c. 56 km WNW of Meekatharra, Western Australia, 30 Oct. 1965, *D.W. Goodall* 3366 (holo: PERTH; iso: CANB).

Erect annual to 25 cm high branching at and shortly above base. Stems loosely woolly, leafy throughout. Leaves cauline, alternate, sessile, very narrow-oblong, c. 10 mm long, 1 mm wide, sparsely woolly with crinkly hairs. Capitula homogamous, solitary, terminal to long branches, almost spherical, c. 10 mm diameter. Involucral bracts multi-seriate, somewhat crinkly, glossy, straw-coloured, similar throughout; intermediate bracts obovate in outline, c. 5 mm long; claw very broad-oblong, hyaline, woolly ciliate on distal margins, stereome spatulate with the terminal portion thickened and bearing a dense tuft of wool on abaxial surface, lamina broad-elliptic, entire, somewhat wrinkled, glabrous, glossy, straw-coloured. Receptacle ovoid, c. 3 mm high, 2.5 mm wide, glabrous, tuberculate with raised achenial scars. Florets numerous, homogamous, bisexual, actinomorphic. Corolla c. 4 mm long to base of lobes; tube narrow-cylindrical, glabrous; limb narrow-campanulate, glabrous; lobes 5, narrow-oblong, c. 1.5 mm long with a few glandular hairs (with large oblongoid terminal cells) on abaxial side, smooth within, vascular strands reaching to base of lobes. Anther appendage ovate, acute, c. 0.6 mm long, cells oblong with unthickened walls, marginal cells not differentiated; anther tails filamentous, weak. Style tip truncate, shortly penicillate, the vascular strand stout, not extending into apex. Achene ellipsoidal, c. 2 mm long, densely long-silky to base, the duplex hairs terminating in two very uneven arms with one very short (c. 0.005-0.01 mm) and the other long (c. 0.3 mm), not myxogenic; pericarp thin, translucent; testa thinly coriaceous, pale brown, the outer cells filled with flat broad-oblong crystals that form an armour-like covering to seed. Pappus bristles slightly shorter than corolla, free, caducous, linear-elliptic and shortly plumose in lower half, filiform and sparsely plumose in upper half, plumose tufted at end.

This species is known only from the type collection for which ecological information is not available.

Rhodanthe sphaerocephala would appear to have no close relative but the morphology of its florets and fruits suggests affinity to other members of the section *Synachyrum*.

Rhodanthe sterilescens (F. Muell.) Paul Wilson, comb. nov.

Helipterum sterilescens F. Muell., S. Sci. Rec. 2:274(1882). - *Argyrocome sterilescens* (F. Muell.) O. Kuntze, Rev. Gen. Pl. 1: 309 (1891). *Type*: Gascoyne River, W.A., 1882, *Pollack* (holo: MEL 110428; iso: PERTH).

This species bears dense clusters of capitula that give it a similar appearance to *Cephalipterum drummondii* with which it has been frequently confused.

Rhodanthe sterilescens differs from *C. drummondii* in the following significant characters: sessile capitula at base of plant in addition to terminal (not all terminal); capitula in a compact cyme (not dense umbel); indumentum woolly (not of curled filiform hairs with septate base and glandular stipitate hairs); achenial hairs slender of the normal duplex type (not clavate helically coiled and

barbed woolly); achenes free, three fertile and silky, the rest sterile and glabrous (not coalescent with 1 or two fertile and the remainder sterile but hairy); achene narrowed at apex (not broad and lobed at apex). The two species are similar in floral characters, in the seed morphology, and in form of the crystals present in the testa.

Rhodanthe stuartiana (Sond. & F. Muell.) Paul G. Wilson, comb. nov.

Helipterum stuartianum Sond. & F. Muell., *Linnaea* 25: 518 (1853). - *Helipterum floribundum* var. *stuartianum* (Sond. & F. Muell.) Benth., *Fl. Austral.* 3:642(1867). Type citation: 'Ad fl. Murray leg. Stuart.' *Lectotype* (here chosen): Ad fl. Murray, *F. Mueller* (MEL 604830).

The type of *Helipterum stuartianum* is stated to have been collected by Stuart. A herbarium O.W. Sonder specimen (MEL 604830) labelled 'Ad fl. Murray' was collected by F. Mueller and bears in (?)Sonder's handwriting the phrase 'Antherae basi bisetae'; these words are used in the published description. A further collection from 'Near the Murray R.' no. 785 (MEL 1539201) was evidently from Stuart. It bears the note 'This plant did not occur in my collection at Adelaide but I found seed of it amongst those you procured from Stephens' [? William Stephens, a garden's collector]. I have selected the Mueller collection (MEL 604830) as the lectotype since it was evidently studied by Sonder.

Rhodanthe troedelii (F. Muell.) Paul G. Wilson, comb. nov.

Helipterum troedelii F. Muell., *Victorian Naturalist* 7:77(1890). Type citation: 'Near the Barrier-Ranges; Mrs Irvine, at Leight's Creeks, beyond Beltana; Mrs Richards.' *Lectotype* (here chosen): Leigh's Creek, 1887, *Mrs Richards* (lecto: MEL 110636; isolecto: MEL 696324, NSW 181421).

Helipterum troedelii var. *patens* Ewart, J. White & B. Rees, *Proc. Roy. Soc. Victoria* 22 n.s.:15(1909) *pro parte* as to lectotype. - *H. roseum* var. *patens* (Ewart *et al.*) J. Black, *Trans. & Proc. Roy. Soc. South Australia* 45:21(1921). Type citation: 'Mt. Lyndhurst, M. Koch, No.1644 (1899); Fraser Range, W. Austr., R. Helms, 1891.' *Lectotype*: Mt Lyndhurst, S. Australia, *M. Koch* 1644 (1899), AD 97650128, *fide* D. Cooke in Jessop & Toelken, *Fl. South Australia* edn 4, 1549(1986).

The syntype material of *H. troedelii* var. *patens* consists of two species. The collection of Max Koch represents *Rhodanthe troedelii* while the collection of R. Helms represents the 'Nullarbor' variant of *R. chlorocephala*. J.M. Black (1921 *l.c.*) indicated that he had examined duplicate material of the Helms syntype and recognised it as being a variant of *Helipterum roseum*, he therefore transferred var. *patens* to that species (which is a synonym of *Rhodanthe chlorocephala*). However, D. Cooke (1986 *l.c.*) lectotypified the name on a Max Koch collection in herb. AD which had been received by Black as a donation from MEL and is probably a duplicate of the Max Koch syntype (it does not bear the month of collection that is present on the syntype). The AD specimen had been annotated by Ewart as 'typical *H. Troedelii*'. In herb. MEL the Max Koch syntype has had the epithet 'var. *patens*' deleted, presumably by Ewart, while the Helms syntype has been labelled 'type'. It would therefore appear that subsequent to its publication Ewart intended to apply the epithet var. *patens* to the element represented by the Helms collection which was also the way in which Black applied the name (as a synonym of *H. roseum*) in 1921 and in the *Flora of South Australia* (1929).

7. Rhodanthe sect. *Helipteridium* (A. Gray) Paul G. Wilson, comb. nov.

Helipterum sect. *Helipteridium* A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:231(1852). *Type: Helipterum discoideum* A. Gray

Helipterum sect. *Aglossum* F. Muell., Fragm. 3:137(1863) *nomen*.

Annual erect herb, sparsely woolly with filiform hairs, and with curled uniseriate septate hairs, eglandular. Major axes slender. Leaves alternate, flat, sessile. Capitula heterogamous, solitary, terminal. Involucre hemispherical, not radiant. Receptacle glabrous with prominent alveolae. Involucral bracts c. 4-seriate, glabrous, glossy, uniform; claw broad-oblong with a broad herbaceous stereome and narrow scarious margins; lamina short, erect, scarious. Florets bisexual or the inner male. Corolla slightly zygomorphic; tube cylindrical, pubescent with gland-tipped hairs; throat turbinate, glabrous; lobes 5, unequal, papillose within, vascular strands extending to apex of lobes. Anther appendix deltoid, cells short and irregular; anther tails filamentous, weak. Style apex truncate with a subulate coalescence of epidermal cells in the centre. Achene ellipsoid, silky pilose with normal duplex hairs; carpodium annular; pericarp brittle; testa soft with numerous oblong crystals, lower 2/3 surrounded by a network of vascular strands. Pappus bristles linear-acuminate, plumose.

A monotypic section.

***Rhodanthe heterantha* (Turcz.) Paul G. Wilson, comb. nov.**

Helipterum heteranthum Turcz., Bull. Soc. Nat. Mosc. 24/1 :198 (1851). *Type: Nova Hollandia, J. Drummond* 4th coll. n.214 (holo: KW photo seen; iso: K, MEL 110231, 110233).

Helipterum discoideum A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:231(1852). *Type citation: 'Variat α, involucre pallido; β, involucre sanguineo. Swan River (β, Swan River to King George's Sound), Drummond.'* (*syn: K 'J. Drummond 96', photo seen*).

Helipterum anactinum F. Muell., Fragm. 3:137(1863). *Type citation: 'Ad sinum orarium Champion Bay. Walcott et Oldfield.'* *Lectotype* (here chosen): Champion Bay, *A. Oldfield* (lecto: MEL 110229).

Helipterum heteranthum var. *majus* Benth., Fl. Austral. 3:643(1867). *Type: Between Moore and Murchison rivers, J. Drummond* 6th coll. n.152 (holo: K; iso: MEL 110226, NSW).

Helipterum pachychaetum W.Fitzg., J. W. Austral. Nat. Hist. Soc. No.2:25(May 1905). *Lectotype* (here chosen): Jacup, 50 miles west of Phillips River, Oct.1903, *C.R.P. Andrews* (lecto: PERTH; isolecto: NSW).

Helipterum heteranthum var. *minor* Ewart, J. White & Tovey, J. Roy. Soc. N.S.Wales 42:190(1908). *Lectotype* (here chosen): Cowcoving, W.A., Oct.1904, *M. Koch* 1108 (lecto: MEL 110220; isolecto: MEL 110221).

8. Rhodanthe sect. *Helichrysoides* (A. Gray) Paul G. Wilson, comb. nov.

Pteropogon sect. *Helichrysoides* A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:267(1852). *Type: Pteropogon spicatus* Steetz

Annual erect herbs, woolly or glandular puberulous. Leaves cauline, alternate, filiform to obovate. Capitula homogamous or heterogamous, clustered, paniculate or condensed in spike-like inflorescences. Involucre turbinate to cylindrical, not radiant; bracts multiseriate, glabrous or glandular pubescent, scarious or with herbaceous tips; stereome small, basal. Receptacle convex to broad-conical, glabrous or scabrid. Florets 5-30, bisexual, or the innermost male. Corolla actinomorphic, sparsely puberulous, narrow-cylindrical below, narrow-campanulate above; lobes ovate, papillose or smooth within, vascular strands extending to tips. Stamens: anther apex ovate the distal cells slightly raised at tip; tails filamentous, weak. Style apex broad to narrow-deltoid, puberulous, vascular strand extending to tip. Achene narrow-obovoid to narrow-turbinate, pilose almost to base; carpodium an extremely short ring; pericarp rough, thick, brittle, dark brown; testa free from pericarp, membranous, vascular strand extending almost completely around seed; crystals absent. Pappus persistent; bristles thick at base, plumose, the cilia all acute.

The section *Helichrysoides* is similar to sect. *Leiochrysium* but differs in the nature of the involucre bracts (foliaceous at apex except in *R. spicata*), the presence of vascular strands at the apex of the corolla lobes, the deltoid style apex, and the thick brittle pericarp. It is also similar to species in the genus *Podothea* in the morphology of the achene, the deltoid style apex, and the foliaceous apex to the involucre bracts. In the latter genus the chromosome number is $n=13, 26$ (Short 1989) whereas in *Rhodanthe* sect. *Helichrysoides* the three species *R. battii*, *R. pollackii*, and *R. spicata*, have a chromosome number of $n = 10$ (B. Turner *in sched.*); the number for *R. charsleyae* has not been recorded. Warcup (1990) has shown that *R. battii* and *R. spicata* do not form ectomycorrhiza whereas species of *Podothea* that have been tested do; this again suggests that the species in sect. *Helichrysoides* should not be placed in *Podothea*.

Rhodanthe battii (F. Muell.) Paul G. Wilson, comb. nov.

Helipterum battii F. Muell., Victorian Naturalist 10:144(1893). Type: Between Dundas-Hills and Lake-Lefroy, 1893, J.D. Batt (holo: MEL 110727).

[*Podothea pollackii* auct. non (F. Muell.) Diels: Diels & Pritzel, Bot. Jahrb. Syst. 35:615-623(1905) as to specimen cited and description.]

Rhodanthe pollackii (F. Muell.) Paul G. Wilson, comb. nov.

Podosperma pollackii F. Muell., Fragm. 12:21(1882); - *Podothea pollackii* (F. Muell.) Diels, Bot. Jahrb. Syst. 35:617(1905). Type citation: 'In vicinia fluminis Gascoyne-River; Forrest et Pollack.' Syntype: Gascoyne River, 1882, J. Forrest (PERTH).

Rhodanthe charsleyae (F. Muell.) Paul G. Wilson, comb. nov.

Helipterum charsleyae F. Muell., Fragm. 8:168(1874). Type citation: 'In vicinia lacus Amadei, Giles; prope lacum Lefroyi, Forrest.' Lectotype (here chosen): Lake Lefroy, State Well, A. Forrest (MEL 110714).

Rhodanthe spicata (Steetz) Paul G. Wilson, comb. nov.

Pteropogon spicatus Steetz in Lehm., Pl. Preiss. 1:479(1845); A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:268(1852). - *Helipterum spicatum* (Steetz) Benth., Fl. Austral. 3:647(1867). Type citation:

'In limoso-calculosis illustribus lateris orientalis montis Lehmann', 4 Sept. 1839, *L. Preiss* 24. *Lectotype* (here chosen): MEL 110492; *islecto* MEL 110493, MEL 604832.

Helipterum monencyanthoides F. Muell., *Fragm.* 3:137(1863). - *H. spicatum* var. *pallens* Benth., *Fl. Austral.* 3:648(1867). Type citation: 'Ad rivos Tom [i.e. Tone] River et Salt River', *G. Maxwell*. *Lectotype* (here chosen): Banks and valleys of Salt River, *G. Maxwell* 75 (MEL 110707).

Calocephalus globosus M. Scott & Hutch., *Kew Bull.* 1916:36(1916). Type: Karing, on York - Greenhills line, Western Australia, *F. Stoward* 505 (holo: K photo seen).

9. *Rhodanthe* sect. *Actinaria* Paul G. Wilson, sect. nov.

Herba annua erecta sparse glanduloso puberula. Folia caulina, alterna, applanata. Capitula homogama, solitaria, terminalia. Involucrum cupulatum ad hemisphaericum, radians; bractae manifeste dimorphae, multiseriatae; bractea exteriora anguste linearia, acuminata, glanduloso puberula; bractae interiores ungue anguste oblongo, lamina ovata, petaloidea. Receptaculum pulvinatum, glabrum, laeve. Flosculi numerosi, bisexuales, homomorphi, actinomorphi. Corolla infra tubulosa supra anguste turbinate, pallido flava, 5-loba; lobi glabri, extra sparse pilosi, intra laeves. Antherae: appendix anguste ovatus, cellulis anguste oblongis parietibus tenuibus; caudae parte proximali firmae, parte distali filamentosae debiles. Styli apex ellipsoideus, nervo carenti. Achenium cylindraceum, c. 1 mm longum, modice pilosum, pilorum longitudine dissimili (0.02-0.2 mm); carpophorum annulare; pericarpium unicellulam crassum, crustaceum; testa membranacea, unicellulam crassum, translucens, crystallis carentibus. Pappi setae filiformes, imo basi connatae, in statu integro caducae, breviter plumosae.

Typus: Rhodanthe margarethae (F. Muell.) Paul G. Wilson

Erect annual herbs, branched, sparsely glandular puberulous. Branches slender, reddish. Leaves cauline, alternate, thin. Capitula homogamous, solitary, terminal to branches. Involucre cup-shaped to hemispherical, c. 2 cm diameter, radiant; bracts distinctly dimorphic; outer bracts narrow-linear, acuminate, c. 4 mm long, glandular puberulous; inner bracts with erect narrow-oblong woolly ciliate claw and spreading ovate petaloid white or pale yellow lamina, the stercome narrow-oblong, thick and glandular puberulous. Receptacle cushion-shaped, c. 5 mm diameter, smooth, papillose around alveolae. Florets numerous, bisexual, 5-merous, actinomorphic. Corolla narrow-tubular below, expanded above, pale yellow, very sparsely puberulous outside, lobes smooth within, cells of inner epidermis of lobes oblong. Stamens: anther tip narrow-ovate acute, cells narrow-oblong, the marginal cells forming an indeterminate row; anther tails firm, equal to collar. Style apex elliptic, shortly papillose, without vasculature. Achene cylindrical c. 1 mm long, moderately short pilose, hairs rounded at apex and of different lengths (0.02-0.2 mm); carpopodium a short glabrous ring; pericarp thin and crustaceous, brown; testa thin, translucent, without crystals. Pappus caducous as a whole; bristles filiform, shortly plumose throughout, connate in ring at base.

A section of two morphologically similar species that are restricted in their distribution to the northwestern region of Western Australia.

The section *Actinaria* differs from other members of the *Rhodanthe* complex in having narrow-linear outer involucral bracts, elliptic style apices that are without vasculature, filiform pappus bristles, and short blunt achenial hairs that are of different lengths. The habit of the two included

species is similar to that of *R. manglesii* in section *Rhodanthe*, as was noted by Mueller in his description of *H. margarethae*, but in floral characters the sections are very distinct.

***Rhodanthe margarethae* (F. Muell.) Paul G. Wilson, comb. nov.**

Helipterum margarethae F. Muell., Fragm. 11:48(1878); F. Muell., Syst. Census Austral. Pl. 80(1882) '*Margaritae*'; F. Muell., Sec. Syst. Census Austral. Pl. 136(1889) '*Margaritae*'; Domin, Biblioth. Bot. 89:667(1929); *Argyrocome margarethae* (F. Muell.) Kuntze, Revis. Gen. Pl. 1:309(1891) '*Margaritae*'. Type citation: 'Ad amnem Jones's Creek et flumen George's River prope Nickol-Bay; J. Forrest'. *Lectotype* (here chosen): Jones Creek and George River south of Roebourne, 1878, J. Forrest (MEL 110234).

Distribution. Pilbara region (Fortescue Botanical District) of Western Australia.

I have not found a syntype that was collected by J. Forrest near Nickol Bay, however, there is a specimen (MEL 110235) labelled by Mueller '*Helipterum Margarethae*, Nickol River, A. Forrest' which is possibly the collection referred to by him since Alexander Forrest was with John Forrest on the expedition to the Nickol Bay area in 1878. This A. Forrest collection is of *Rhodanthe frenchii*. Mueller describes the leaves as '*amplexantibus*' and the involucre bracts as '*candida*', that is, pure white, terms that apply to *R. margarethae* as lectotypified by the 'Jones Creek and George River' specimen, but not to the Nickol River collection.

The epithet '*margarethae*' honours Margaret Forrest (1845-1929), wife of John Forrest the explorer and statesman. Mueller evidently considered a preferred latinization of her name to be '*margaritae*' for he used this variant in 1882 and 1889 as did Otto Kuntze in 1891.

***Rhodanthe frenchii* (F. Muell.) Paul G. Wilson, comb. nov.**

Helipterum frenchii F. Muell., S. Sci. Rec. 3:34(1883). Type citation: 'Near Menilayalya in the vicinity of Shark-Bay; J. Forrest' (holo: MEL 50293 'Head of Menilayalya R., 1882, J. Forrest').

[*Helipterum margarethae* F. Muell., Fragm. 11:48(1878) *pro parte* as to the Nickol River collection, not as to lectotype]

Distribution. Northern Carnarvon and north-west Ashburton Botanical districts of Western Australia.

10. *Rhodanthe* sect. *Anisolepis* (Steetz) Paul G. Wilson, comb. et stat. nov.

Anisolepis Steetz in Lehm., Pl. Preiss. 1:446(1845). Type: *Anisolepis pyrethrum* Steetz

Annual erect herb, glabrous or sparsely and minutely puberulous. Stem simple or branched above, towards the base thickened and aerenchymatous. Leaves cauline, simple, entire, alternate or the lower opposite, if submerged filiform, otherwise oblong and somewhat fleshy, c. 5 mm long, towards the apex becoming ovate and with scarious margins. Capitula homogamous, solitary and terminal to stem and branches. Involucre at first turbinate, becoming hemispherical with age, often subtended by the uppermost leaves; bracts 2-seriate, all radiant and with claws: claw erect, narrow-deltoid, c. 1 mm long, margin scarious, sterome prominent, narrow-oblong, thick and raised, sparsely glandular, limb

petaloid, radiating, white, elliptic, c. 5 mm long, eventually breaking away from the persistent claw. Receptacle narrow-conical, deeply foveolate, fimbriiferous around foveolae. Florets numerous, bisexual. Corolla tube cylindrical, c. 1.5 mm long, sub-campanulate above, shortly 5-lobed; lobes triangular, abaxial surface with a few hairs that have large ovoid gland-cells at their tips, two of the lobes with adaxial surface papillose at base, the others glabrous, margins thickened; cells of inner epidermis of lobes irregularly oblong, of the neck oblong and undulate on margin. Anthers included; terminal appendage broad-oblong, obtuse, thin, cells oblong, thin-walled; tails weak and filamentous. Style tips rounded to acuminate; vascular strand extending to base of tip. Achene barrel-shaped, c. 1 mm long, dark reddish brown, pilose with fine hairs, not myxogenic; carpodium very short, annular; pericarp very thinly crustaceous, pale brown; testa mauve, thinly coriaceous, vascular strands not apparent; crystals absent. Pappus c. 1 mm long of c. 10 narrowly triangular serrate scales united in lower half, tardily deciduous as a whole.

***Rhodanthe pyrethrum* (Steetz) Paul G. Wilson, comb. nov.**

Anisolepis pyrethrum Steetz in Lehm., Pl. Preiss. 1:447(1845). - *Helipterum pyrethrum* (Steetz) Benth., Fl. Austral. 3:642(1867). - *Argyrocome pyrethrum* (Steetz) Kuntze, Revis. Gen. Pl. 1:309(1891). Type citation: 'In depressis uliginosis sylvae supra oppidulum Perth, d. 26. Sept. 1839. Herb. Preiss. No. 14.' *Lectotype* (here chosen): MEL 108293; *isolecto*: MEL 108294.

There is some variability within this species but it is unclear as to how much is due to growth conditions. Collections made to the north of Perth have the lower (underwater) leaves linear-acuminate and opposite, whereas collections made to the south of Perth have the underwater leaves filiform and scattered. There are also slight differences between different populations in the size of achenes, in the distribution of the globular glands, and in the branching of the inflorescence. However, all these characters show such variability over the total species range that specific or infraspecific discrimination does not appear practicable.

Rhodanthe pyrethrum is similar in some features to the species in *Rhodanthe* sect. *Achyroclinoides*, noticeably in the size and morphology of the achene. It differs from this section and from other sections of *Rhodanthe*, in the nature of the involucre bracts which are all radiant and which have claws that possess a very thick narrow-oblong stereome, in the lacinate scales of the pappus, and in the rounded to acuminate style apices.

11. *Rhodanthe* sect. *Polyphyllum* Paul G. Wilson, sect. nov.

Herba annua, modice lanosa, glandis sessilibus globosis sparse ornata. Folia numerosa, alterna, filiformia. Inflorescentium corymbosum. Capitula homogama, radiantia. Involucrum late turbinatum c. 5 mm altum; bractae intermediae scariosae, sparse lanosae, stereomate anguste oblongo, crasso; bractae intimae similis sed limbo albo ornato. Flores 8-12, bisexuales; corolla tubularis, sparse glanduloso puberula, lobis 5, brevibus, intra glabris, nervis ad apicem extensis. Antherum appendice late ovato, crasso, caudis collum aequantibus, crassis, ramosis. Styli apex truncati, nervo crasso sub-apice extenso. Achenium doleiforme, truncatum, modice hirtellum; carpodium crassum; pericarpium crustaceum, rugosum; testa chartacea, libra, nervo 3/4 circumdato; nervis pericarpi et testae in posite laterali locatis. Pappus corollam aequans; setae filamentosae, breviter plumosae, caducae.

Typus: Rhodanthe polyphylla (F. Muell.) Paul G. Wilson

Annual erect herb, somewhat woolly and with scattered minute globular reddish brown glandular hairs, single stemmed. Leaves numerous, filiform. Inflorescence a terminal corymb. Capitula homogamous, shortly pedunculate, radiant. Involucre broadly turbinate c. 5 mm high; bracts c. 4-seriate; outer and intermediate bracts scarious, sparsely woolly with a thick narrow-oblong stereome; innermost bracts similar but with a short oblong white limb. Florets 8-12, bisexual; corolla narrow-tubular, slightly broader above, sparsely glandular puberulous; lobes 5 short, glabrous within, sparsely glandular puberulous outside, cells of inner epidermis narrow-oblong, vascular strands passing to apex of lobes. Anther appendage broad-ovate, thick, cells unevenly oblong; anther tails stout, branched, equal to collar. Style apex truncate, vascular strand thick and extending to just below apex. Achene barrel-shaped with a truncate apex, moderately hirtellous with slender duplex hairs; carpodium thick; pericarp crustaceous, rough; testa papery, free from pericarp, vascular strand passing over apex of seed; vascular strands of pericarp and of testa in lateral position (in relation to cotyledons). Pappus equal to corolla; bristles filamentous, shortly plumose, shortly united at base, caducous.

Note. A number of features make this monotypic section unique in the *Helichrysum* complex; these are: 1) the numerous cauline, lanate, filiform leaves, 2) the short, stout, branched anther tails, and 3) the thick anther appendage with unevenly shaped oblong cells. Its position in relation to the other sections of *Rhodanthe* and to genera in the *Cassinia* complex is unclear. It is likely that this section should be recognised as a distinct genus.

***Rhodanthe polyphylla* (F.Muell.) Paul G. Wilson, comb. nov.**

Helipterum polyphyllum F. Muell., *Fragm.* 1:35(1858). - *Argyrocome polyphylla* (F. Muell.) Kuntze, *Revis. Gen. Pl.* 1:309(1891). Type citation: 'In planitiibus basalticis a fluvio Brisbane usque ad montes Peak Range. - In tractu Kent's Plains. W. Hill.' *Lectotype* (here chosen): Brisbane River, Peak Range, F. Mueller (MEL 109740); *syntype*: Moreton Bay, Kents Plains, *anon.* (MEL 109757).

Distribution. Eastern Queensland and north-east New South Wales.

Cephalipterum A. Gray

***Cephalipterum* A. Gray**, Hooker's J. Bot. Kew Gard. Misc. 4:271(1852). Type: *Cephalipterum drummondii* A. Gray

Annual erect herb, indumentum of curled filiform hairs septate at base with glandular stipitate hairs below capitula. Leaves cauline and basal, linear to obovate. Capitula heterogamous, very shortly pedunculate in dense terminal umbels. Involucre cup-shaped; bracts multiseriate, scarious, the innermost with a white or yellow lamina. Receptacle small, conical, glabrous. Florets numerous; 1-2 outer bisexual, remainder male. Corolla narrow-urceolate, shortly 5-lobed, glabrous, lobes smooth within; vascular strands terminating in tube. Anthers: appendix ovate with narrow-oblong cells; collar short and broadly expanded at base; tails weak; style apex truncate, somewhat broader than style branch, prominently papillose. Achene broadly compressed obovoid with a broad-circular apex that has a hard raised lip on the abaxial margin; sterile achenes hard, broad-obovoid, the apical surface vertical; attachment small, carpodium absent; indumentum (fertile and sterile achenes) of dense white clavate helically coiled duplex hairs on abaxial surface, of woolly clawed simple hairs on adaxial surface; pericarp thick and hard; testa thinly coriaceous closely covered all over with broad-

oblong imbricate crystals; vascular strands of pericarp and testa medial in relation to the broad-obovate embryo. Pappus bristles free, caducous, linear to filiform, shortly plumose in upper half, the terminal cilia congested, thickened and recurved.

Cephalipterum drummondii A. Gray, *op.cit* 272. Type citation: 'Swan River, Drummond.' *n.v.*

Cephalipterum drummondii f. *major* Diels & Pritz., Bot. Jahrb. 35:615(1905) *nom.illeg.* (based on type *forma*).

Cephalipterum drummondii f. *minor* Diels & Pritz., *l.c.*

Type citation: 'hab. in distr. Coolgardie pr. Kanowna flor. m. Aug. (W.V. Fitzgerald in hb. Berl.); in distr. Austin pr. Murrinmurrin fl. m. Nov. (W.J. George).' *Neotype* (here chosen): Kanowna, August 1898, W.V.Fitzgerald (PERTH).

Note. The syntype material in herb. B is destroyed, I have therefore chosen as neotype a probable isosyntype in PERTH.

This genus is similar in many features to species in *Rhodanthe* sect. *Synachyrum*, in particular in possessing a dense imbricate crystalline cover to the seed. Only one or two seeds in the capitulum are fertile but these coalesce to the sterile achenes by means of a dense mass of barbed hairs on their adaxial surfaces which cause the entire cluster to be dispersed as one unit from which one seedling emerges with the sterile achenes forming a persistent ring around the base of the root. The fertile achenes bear at their tip a raised rim on their abaxial margin; this character is unique in the *Rhodanthe* complex.

A number of variants of this species occur which vary in the size and colour of the involucre bracts with sometimes two or more variants being present at the same locality. It is probable that the variants have edaphic preferences but speculation on this matter has still to be confirmed. Some of these variants may warrant recognition; Turner (1970) has recorded chromosome counts of $n = 12$ and $n = 14$ for the species, however, the voucher material (PERTH) for the counts appears to be morphologically identical.

Erymophyllum Paul G. Wilson

Erymophyllum Paul G. Wilson, Nuytsia 7:105(1989).

Type: *Erymophyllum gracile* (A. Gray) Paul G. Wilson.

Pteropogon sect. *Helipteroides* A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:269(1852). *Lectotype:* *Pteropogon gracilis* A. Gray (Wilson 1989b).

For list of species see Wilson 1989b.

The Hyalosperma group

Hyalosperma Steetz

Hyalosperma Steetz in Lehm., Pl. Preiss. 1:476(1845). *Lectotype*: *Hyalosperma glutinosum* Steetz (Wilson 1989a).

Helipterum sect. *Pachypterum* Steetz in Lehm., Pl. Preiss. 1:473(1845). *Lectotype*: *Helipterum cotula* (Benth.) DC. (Wilson 1989a).

Pteropogon sect. *Pteropogonopsis* A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:269(1852). *Type*: *Pteropogon demissus* A. Gray.

For description and list of species see Wilson 1989a.

Gilberta Turcz.

Gilberta Turcz., Bull. Soc. Nat. Mosc. 24/1:192 (pre 27 March 1851). *Type*: *Gilberta tenuifolia* Turcz.

Antheidosorus A. Gray, Hooker's J. Bot. Kew Gard. Misc. 3:98 (April 1851). *Type*: *Antheidosorus gracilis* A. Gray.

Erect annual, moderately arachnoid. Leaves alternate, filiform. Capitula heterogamous, terminal to short lateral branches, nutant in fruit. Involucre turbinate to hemispherical, c. 4 mm high, radiant; outer bracts very broadly ovate, hyaline, slightly woolly at base; intermediate bracts with a broad hyaline slightly woolly claw and a short spreading yellow limb; innermost bracts obovate, hyaline, pale yellow, not radiating; stereome of ray bracts short and triangular. Receptacle flat, covered with scarious narrow-oblong receptacular bracts of which c. 5 surround each floret. Florets actinomorphic, the outer row bisexual and the remainder male. Bisexual florets: Corolla glabrous, the vascular strands terminating at apex of throat; tube narrowly cylindrical; throat very short and turbinate; lobes 5, oblong, acute, prominent, smooth within, the cells narrow-oblong with straight walls. Anthers exserted; terminal appendage ovate, c. 0.2 mm long, cells narrow-oblong with thin walls; tails weak and filamentous. Style apex narrow-ovate to deltoid, densely papillose, the vascular strand slender and extending to base of apex. Achene compressed obovoid, c. 1.5 mm long, minutely colliculate; carpodium minute (scarcely apparent); pericarp thick and transparent, strongly myxogenic; testa thinly coriaceous, brown, without crystals, vascular strands not apparent. Sterile achenes linear. Pappus of 5 unequal linear-acuminate shortly plumose bristles of which one or two have clavate terminal cilia; pappus of fertile florets weak and caducous as a whole, of male florets indurated at base and persistent on achene.

Gilberta tenuifolia Turcz., *op.cit.* 193. *Type*: Western Australia, *J. Gilbert* 277 (holo: KW).

Antheidosorus gracilis A. Gray, Hooker's J. Bot. Kew Gard. Misc. 3:174 (June 1851). - *Myriocephalus gracilis* (A. Gray) Benth., Fl. Austral. 3:559(1867). *Type*: Swan river Colony, *J. Drummond*, n.v.

Helipterum verecundum S. Moore, J. Linn. Soc. 34:200(1899). Type citation: 'Juxta Coolgardie repperi mens. Aug. florcentem', S. Moore, n.v.

Asa Gray (1851) suggested that, due to the presence of receptacular bracts, this species had affinities to *Myriocephalus*. However, as has been pointed out by Short *et al.* (1989), *Gilberta* has little in common with *M. appendiculatus* Benth., the type of *Myriocephalus*. The florets and achenes of *Gilberta tenuifolia* are, in fact, very similar to those of *Hyalosperma*, particularly to *H. glutinosum* (Steetz) Paul G. Wilson. Both of these species have a similar corolla with narrow-oblong cells in the inner epidermis of the lobes, almost identical anthers and style apices, a similar pappus, and very similar achenes in which the pericarp forms a pellucid myxogenic layer around the seed. The leaves and indumentum of *Gilberta* are also of the same form as those found in *Hyalosperma*. *Gilberta* differs most obviously in the arrangement of the capitula and in the presence of capitular bracts around each floret; it also has glabrous corolla lobes whereas in *H. glutinosum* the corolla lobes have hairs that possess a large ovoid terminal gland.

According to Warcup (1990) both *Gilberta* and *Hyalosperma* form an ectomycorrhizal association while four species currently placed in *Myriocephalus* that have been tested do not.

The two names, *Gilberta* and *Antheidosorus*, were evidently published within a few days of each other. A copy of the Bull. Soc. Imp. Naturalistes Moscou 24/1 was lodged with the Censor on 17 January 1851 (Old Style Calendar) and presented to the Society on 15 March 1851 (O.S.) which is equivalent to 27 March 1851 (New Style). I have taken the date on which it was presented to the Society as being the date of publication (see Stafleu 1969, Marchant 1989). According to Stafleu and Cowan (1979), p.98 of Hooker's J. Bot. Kew Gard. Misc. vol. 3 was published in April 1851 and p.174 in June 1851.

The spelling *Gilberta* (and not *Gilbertia*) was deliberately used by Turczaninow in order that it could be better distinguished from *Gilbertia* Ruiz & Pav., a genus in the Araliaceae.

The Triptilodiscus group

Triptilodiscus Turcz.

Triptilodiscus Turcz., Bull. Soc. Imp. Naturalistes Moscou 24/2:66(Aug.-Nov. 1851). Type: *T. pygmaeus* Turcz.

Dimorpholepis A. Gray in Hooker, Icon. Pl. 9:t.856(Sept.-Nov.1851); A. Gray, Hooker's J. Bot. Kew Gard. Misc. 4:227(Aug.1852). Type: *D. australis* A. Gray.

Duttonia F. Muell., Linnaea 25:409(1853). Type: *D. sessiliceps* F. Muell.

Annual herb with several major axes, sparsely pilose with slender hairs. Leaves alternate linear to narrow-oblong. Capitula heterogamous, terminating branches and subtended by c. 5 leaves of which one or more may bear a shoot that continues growth to give a monochasial confluence. Involucre subglobular c. 6 mm high, not radiant. Outer bracts scarious, hyaline, narrow-elliptic, \pm equal to head, long-ciliate with linear sterome. Inner bracts narrow-oblong, slightly exceeding outer

bracts, cartilaginous and prominently thickened with narrow scarious shortly ciliate margin and scarious ciliate apex, somewhat boat-shaped, hispidulous abaxially. Receptacle broad-conical, smooth, glabrous. Florets discoid, a few outer female, remainder bisexual. Female florets: corolla very narrow-tubular 2-2.5 mm long, narrow-urceolate at apex, eventually curved outwards, very shortly 3-dentate, minutely and sparsely glandular puberulous with uniseriate hairs; inner cells of urceolate portion with sinuate margins, lobes densely papillose within; pappus a short corona of barbellate scales, sometimes with one shortly plumose bristle. Bisexual florets: corolla narrow-tubular, urceolate above, minutely 4-dentate, c. 2.5 mm long, at first erect eventually curved outwards, otherwise as in female florets; anther-appendage oblong, very thin, cells narrow-oblong, unthickened; anther tails filamentous, shorter than collar; style apex truncate; achene narrow-cylindrical, c. 1.8 mm long, minutely puberulous with 2-celled tooth-like hairs rounded at apex; pericarp diaphanous; testa leathery, smooth, without crystals; boss a minute narrow ring; pappus bristles 3-4, linear-acuminate, shortly plumose, c. 2.5 mm long, persistent,

***Triptilodiscus pygmaeus* Turcz., l.c. - *Helipterum pygmaeum* (Turcz.) Druce in Hayward & Druce, Advent. Fl. Tweedside 103(1919) comb. illeg. Type: Western Australia, J. Drummond 5th coll. n.54 (iso: MEL 109204).**

Dimorpholepis australis A. Gray, l.c. - *Helipterum dimorpholepis* Benth., Fl. Austral. 3:650(1867) nom. illeg. - *Argyrocome dimorpholepis* Kuntze, Revis. Gen. Pl. 1:309(1891). - *Helipterum australe* (A. Gray) Druce, Bot. Exch. Club Brit. Isles 1916, 4:627(1917). Type citation: 'Hab. South-western Australia, Drummond. Also in the interior of Eastern Australia, at Bathurst Plains, Fraser; and Nangers, Captain M'Arthur.' Syntype: J. Drummond 54 (K, photo seen).

Duttonia sessiliceps F. Muell., Linnaea 25:410(1853). Type citation: 'In pratis prope rivum Rocky-creek.' Lectotype (here chosen): Rocky Creek, Oct. 1851, F. Mueller (lecto: MEL 109152; isolecto: MEL 109197).

There is uncertainty over the publication dates of *Triptilodiscus* Turcz. and *Dimorpholepis* A. Gray. The former name was published in the Bull. Soc. Imp. Naturalistes Moscou vol.24 part 2 no. 3 which was sent to the Censor on 15 August 1851 and presented to the Society on 5 November 1851 (New Style calendar). The latter name was published as tab. 856 of the Icones Plantarum which appeared between September and November 1851 or possibly later, *fide* C. Jeffrey *in litt.* I have adopted the Turczaninow name, as did Laurie Haegi (1986), since there is the greater likelihood of it having priority.

This genus is closely related to *Haegiella* which shares the same branching habit of the confluence, as well as the same hair type, and similar corolla and achene characters. *Haegiella* differs principally in the absence of a pappus, the presence of crystals in the testa, and the presence of unthickened inner involucre bracts.

Haegiella P. Short & Paul G. Wilson

***Haegiella* P. Short & Paul G. Wilson, Muellera 7:259(1990). Type: *Haegiella tatei* (F. Muell.) P. Short & Paul G. Wilson**

For description and discussion see Short & Wilson, *op.cit.*

Pterochaeta Steetz

Pterochaeta Steetz in Lehm., Pl. Preiss. 1:456(1845). Type: *Pterochaeta paniculata* Steetz

Annual woolly herb with one to several major axes. Leaves alternate, oblong. Capitula homogamous, shortly pedunculate, racemously arranged, subtended by two leafy bracts. Involucre broad urceolate; bracts multiseriate, long ciliate, woolly, pale yellow; outer bracts ovate, scarious, attenuate at base with a minute hard green stereome, shortly apiculate with a pale fawn lamina; intermediate bracts broad-ovate scarious with a narrow-oblong hard claw (stereome) and a short oblong lamina; innermost bracts very short on a narrow-oblong hard naviculiform claw; receptacle naked; florets c. 20, outer female, inner bisexual, actinomorphic. Corolla cylindrical, shortly 4-lobed in female, 5-lobed in bisexual, glabrous; lobes glabrous within, thickened on margin; cells of throat undulate. Anther c. 0.7 mm long, delicate, appendage short, thin; tails filamentous. Style apex truncate. Achene narrow-ellipsoid, shortly beaked, covered with 2-celled tooth-like papillae; pericarp thin and weak, transparent, myxogenic, vascular strands laterally placed in relation to the cotyledons; testa leathery, brown rugulose, cells very thick walled and deeply undulate with scattered narrow-oblong crystals, vascular strand laterally placed and confined to near base of seed; carpodium minute, annular. Pappus equal to corolla; bristles plumose, persistent.

One species endemic to southern Western Australia.

Pterochaeta paniculata Steetz in Lehm., *op.cit.* 455. - *Waitzia paniculata* (Steetz) Benth., Fl. Austral. 3:637(1867). *Lectotype* (here chosen): In limoso-arenosis planitie haud longe a praedio rustico "Maddington", et sinu regis Georgii III., Nov.[18]39 et [18]40. L. Preiss. No.35. (lecto: MEL 1585199; isolecto: LD).

The genus *Waitzia* differs from *Pterochaeta* most obviously in habit, in the nature of the anther apiculum and anther tails, in having a stout deltoid style apex with a vascular strand extending to the tip, and in the form of the achene. The vascular strands of the pericarp in *Waitzia* are medially placed in relation to the cotyledons whereas in *Pterochaeta* they are laterally placed.

Haptotrichion Paul G. Wilson, gen. nov.

Herba annua erecta pilis septatis glandulosis pubescens. Folia caulina alterna lincaria. Capitula homogama, solitaria radiantia. Involucrum hemisphericum; bractae c. 4-seriatae; bractae exteriores elliptica hyalina longe ciliata, stereomate anguste oblongo plano; bractae intimae ungue anguste elliptico longe ciliato, stereomate anguste oblongo, lamina elliptica flava. Receptaculum minute glanduloso papillosum. Flosculi numerosi, bisexuales, actinomorphi. Corolla tubo gracili glanduloso piloso, limbo campanulato glabro; lobi 5, ovati, nervis ad apicem extensis. Antherae: appendix ovatus tenuis, cellulis marginalibus manifeste discretis, cellulis basalibus \pm equilateralibus, cetera anguste oblongis; caudae filamentosae collum superantes. Styli apex truncatus. Achenium angusto ellipticum compressum, ad apicem in rostro productum, papillis 2-cellulis dentoideis ornatis; pericarpium: stratum exterius cellulis cubicis parietibus tenuibus; stratum interius cellulis incrassatis, lignosis, sclerenchymatis; testa tenuissima, nervo circumnEXO. Pappus persistens, setis filiformibus, denticulatis, basi versus in tubo conjunctis.

Typus: Haptotrichion conicum (B. Turner) Paul G. Wilson

Annual erect herbs pubescent with gland-tipped septate hairs. Leaves cauline, alternate, linear. Capitula solitary and terminal to long branches, radiant. Involucre hemispherical; bracts c. 4-seriate; outer bracts elliptic, hyaline, long-ciliate with a brown narrow-oblong flat stereome; innermost bracts with a narrow-elliptic hyaline long-ciliate claw, a narrow-oblong stereome, and a yellow elliptic lamina. Receptacle minutely glandular papillose. Florets numerous, bisexual, actinomorphic. Corolla: tube slender, glandular pilose; limb campanulate, glabrous; lobes five, ovate, vascular strands extending to tips. Anther; appendage ovate, thin, marginal cells differentiated, basal cells \pm equilateral, medial and distal cells narrow-oblong; tails slender delicate, extending to beyond collar. Style apex truncate; vascular strand prominent, extending almost to tip. Achene narrow-elliptic, compressed, extending into a terminal beak, minutely papillose with 2-celled tooth-like trichomes; carpodium annular, short; pericarp: outer layer of 1-cell thick layer of thin-walled cubical cells; inner layer of 2-3 rows of thick walled sclerenchymatous cells; testa extremely thin, more or less adherent to pericarp; endosperm thin, free from testa; vascular strands of pericarp lateral (in relation to cotyledons); vascular strand of testa passing almost completely around seed in lateral position. Pappus bristles filiform, barbellate, united below to form a cup-shaped base, entire or slit on one side, persistent.

Haptotrichion conicum had been placed in *Waitzia* since it possessed beaked achenes. It differs from *Waitzia* most obviously in 1) having a different type of indumentum (not cottony), 2) having broad flat hyaline claws to the inner involucre bracts (not terete and firm), 3) in having truncate style apices (neither ellipsoid nor deltoid), and 4) in having delicate filamentous anther tails (not slender and firm). *Haptotrichion* further differs from *Waitzia* in the anatomy of the achene for its pericarp has an outer single-celled layer of thin-walled cube like cells and an inner layer of several rows of thick-walled sclerenchymatous cells, while the testa is extremely thin and delicate. In *Waitzia* the pericarp consists of a thin layer of hyaline linear cells while the testa is thick, rugose, and made up of thick-walled collenchyma. The vascular strand in the testa of *Haptotrichion* passes almost completely around the seed but in *Waitzia* it is confined to the base.

From *Pterochaeta* this genus differs in the manner of branching of the stem and inflorescence (q.v.), in the nature of the involucre bracts, the nature of the corolla, and the nature of the anther apiculum. In *Pterochaeta*, *Haptotrichion* and *Waitzia* the achenes are beaked and bear tooth-like 2-celled trichomes but in other characters the genera are very distinct.

The genus consists of two species, both endemic to the Carnarvon District (Beard 1980) of Western Australia.

***Haptotrichion colwillii* Paul G. Wilson, sp. nov. (Figure 6)**

Herba erecta ad 25 cm alta. Rami glanduloso puberuli sub capitula pilosi. Folia linearia, 8-15 mm longa, glanduloso puberula. Involucrum hemisphaericum, c. 10 mm altum et latum; bracteis exterioribus late ellipticis, hyalinis, ciliatis; bracteis intimis ungue anguste elliptico, c. 9 mm longo, hyalino, ciliato, limbo anguste obovato obtuso, 9-15 mm longo, luteo. Corolla c. 5 mm longa, tubo glanduloso lirtello, limbo anguste turbinato, glabro, intra sub lobis papilloso. Achenium anguste ellipsoideum c. 2.5 mm longum, denticulatum; rostrum gracile, laeve, ad 3 mm longum. Pappus persistens, setis in basi connatis, tubiformibus.

Typus: 7 km S of Overlander Roadhouse [c. 170 km S of Carnarvon], Western Australia, 1 Sept. 1985, H. Demarz 10702 (holo: PERTH).

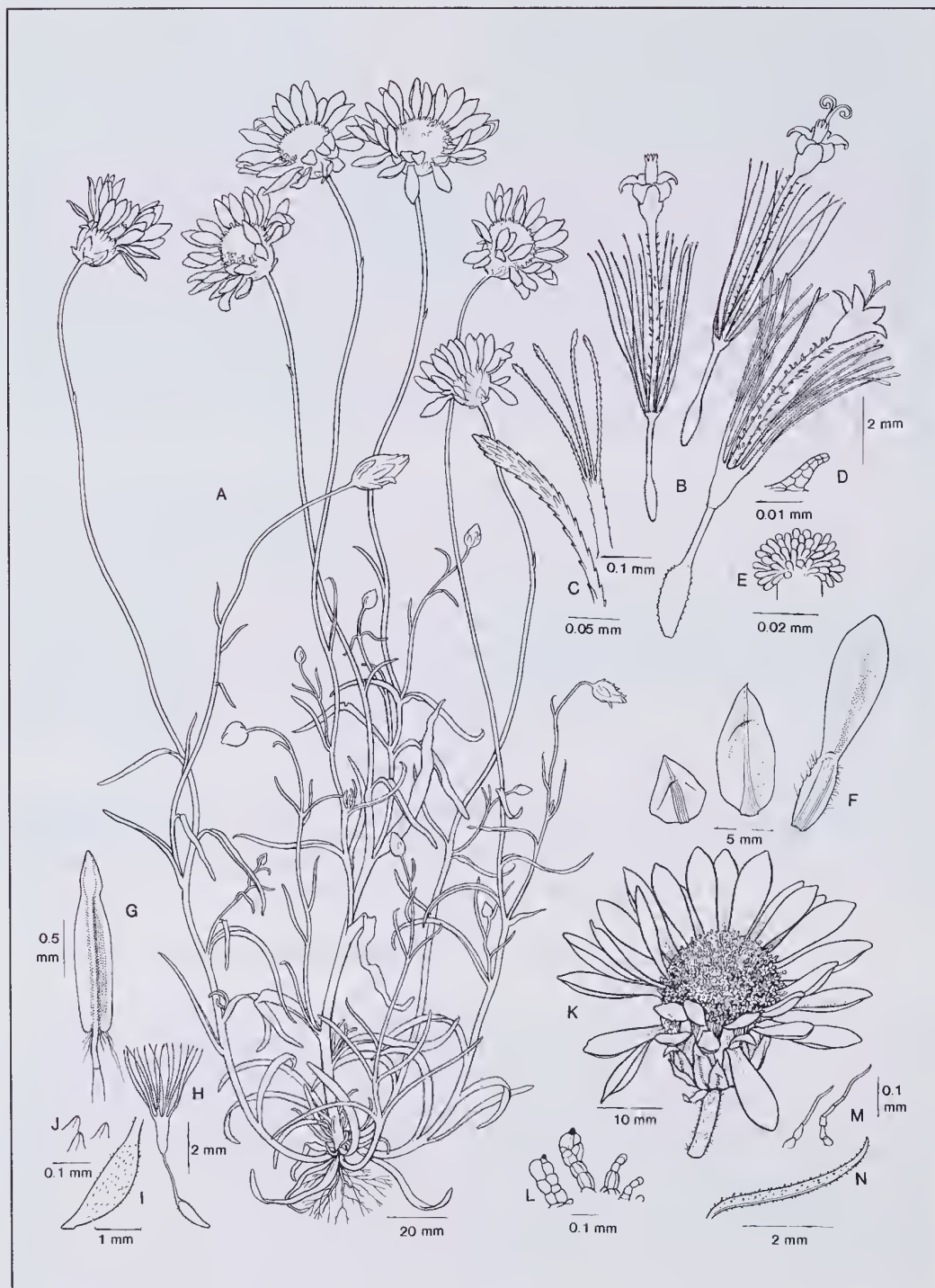


Figure 6. *Haptotrichion colwillii*. A - Habit. B - Florets. C - Pappus bristle apices. D - Hair of corolla. E - Style apex. F - Outer, intermediate, and inner involucre bracts. G - Anther. H - Achene with pappus. I - Achene. J - Achene papillae. K - Capitulum. L & M - Hairs of stem. N - Leaf. From H. Demarz 10702.

Erect herb to 25 cm high, branching at base. Principal axes slender, to 20 cm high, simple or sparsely branched, glandular puberulous, pilose beneath capitulum. Leaves linear, 8-15 mm long, c. 0.7 mm wide, glandular puberulous, margins slightly recurved. Involucre hemispherical, c. 10 mm high and wide. Outer bracts broad-elliptic, hyaline, ciliate; stereome narrow-triangular, brown, glandular puberulous. Innermost bracts: claw narrow-elliptic, c. 9 mm long, hyaline, ciliate, stereome very narrow-oblong, glabrous except for the glandular puberulous apex; limb narrow-obovate, obtuse, 9-15 mm long, yellow. Corolla c. 5 mm long; tube narrow, glandular hirtellous with multicelled hairs; limb narrow-turbinate, glabrous, shortly 5-lobed, papillose within below junction of lobes. Achene compressed narrow-ellipsoid, c. 2.5 mm long, barbellate with 2-celled papillae; beak slender, smooth, to 3 mm long. Pappus more or less equal to corolla, persistent, bristles united towards base to form a tube c. 2 mm long.

Additional specimen examined. WESTERN AUSTRALIA: Hamelin Pool, 16 Sept. 1984, J. Colwill s.n. (PERTH).

Habitat. Found on red sand over limestone (*fide* H. Demarz in sched.).

Distribution. Only known from near Hamelin Pool, c. 170 km south of Carnarvon, Western Australia.

Notes. *Haptotrichion colwillii* is very similar to *H. conicum* which is known from an area between Carnarvon and Gascoyne Junction. The latter species differs most obviously in 1) the leaves ending in a rounded 'capitate' tip, 2) the receptacle being narrow-conical (not rounded), and 3) the pappus sheath being split along one side.

Haptotrichion colwillii is named after John Colwill, a Western Australian horticulturalist who has a particular interest in the native Asteraceae and who first collected this species.

The illustration is drawn from a plant raised from seed collected by Herbert Demarz and grown at Kings Park Botanic Garden, Perth. I should like to thank the staff of Kings Park for their unstinted assistance in my study of this and other annual species of the *Rhodanthe* complex.

Haptotrichion conicum (B. Turner) Paul G. Wilson, comb. nov.

Waitzia conica B. Turner, Sida 2:428(1966). *Type:* 11 miles west of Gascoyne Junction, 24 Aug. 1965, B.L. Turner 5405 (holo: MEL 598263; iso: MEL 598265, PERTH).

[*Waitziapodolepis* auct. non (Gaud.) Benth.: F. Muell., Zeitschrift des allgem. österreich. Apotheker-Vereines 34 (no.36):933-936 (1896); F. Muell., Pl. Indig. Sharks Bay 16(1883).]

Distribution. Between Carnarvon and Gascoyne Junction, Western Australia.

A description of this species was provided by Mueller (1883) based on a collection made by J. Polak (or Pollack) in 1882 from the Gascoyne River region (MEL 1584941). Mueller assumed that the plant he was describing was *Waitzia podolepis* (Gaudich.) Benth.: 'this plant represents evidently the genuine species, illustrated by Gaudichaud', even though Mueller had seen no authentic material of that species. In 1896 Mueller again included the Pollack specimen under *W. podolepis* but without comment. In 1905 Diels and Pritzel stated that the Pollack collection was not *W. podolepis*, however, they did not give it a name.

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I thank the various Australian herbaria who sent on loan much of their material of *Helipterum* for study. Kings Park Botanic Garden allowed me to have access to their live collection and provided me with seed of a number of species. Steve Hopper kindly searched for and collected from different populations of rare *Rhodanthe* species near Shark Bay. Photographs of relevant Asteraceae types in herb. KW were made available to me by my colleague Neville Marchant. Discussions and correspondence with Philip Short and Arne Anderberg have been stimulating and of considerable assistance. The drawings were prepared with much care by Margaret Menadue.

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Name changes in Australian species of *Helipterum* (see also Wilson 1989a,b and 1992a,b)

Taxa listed in Hnatiuk (1990)

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H. albicans

H. albicans subsp. *albicans*

H. albicans var. *buffaloensis*

H. albicans var. *incanum*

H. albicans subsp. *alpinum*

H. albicans var. *graminifolium*

H. anthemoides

H. australe

H. battii

H. charsleyae

H. chlorocephalum

H. condensatum

H. corymbiflorum

H. corymbosum

H. cotula

H. craspedioides

H. demissum

H. diffusum

H. fitzgibbonii

Taxa accepted by Wilson

Chrysocephalum puteale (S. Moore) Wilson

Leucochrysum albicans (A.Cunn.) Wilson

Leucochrysum albicans subsp. *albicans*

Leucochrysum albicans var. *buffaloensis* (Wilson)
Wilson

Leucochrysum albicans subsp. *albicans* var. *tricolor*
(DC.) Wilson

Leucochrysum albicans subsp. *alpinum* (F. Muell.)
Wilson

Leucochrysum graminifolium (Wilson) Wilson

Rhodanthe (*Leiochrysum*) *anthemoides* (Sprengel)
Wilson

Triptilodiscus pygmaeus Turcz.

Rhodanthe (*Helichrysoides*) *battii* (F. Muell.) Wilson

Rhodanthe (*Helichrysoides*) *charsleyae* (F. Muell.)
Wilson

Rhodanthe (*Leiochrysum*) *chlorocephala* (Turcz.)
Wilson subsp. *chlorocephala*

Rhodanthe (*Achyroclinoides*) *condensata* (F. Muell.)
Wilson

Rhodanthe (*Leiochrysum*) *corymbiflora* (Schldl.) Wilson

Rhodanthe (*Achyroclinoides*) *corymbosa* (A. Gray) Wilson

Hyalosperma cotula (Benth.) Wilson

Possibly referable to *Polycalymma*

Hyalosperma demissum (A. Gray) Wilson

Rhodanthe (*Leiochrysum*) *diffusa* (Cunn. ex DC.) Wilson
var. *diffusa*

Leucochrysum fitzgibbonii (F. Muell.) Wilson

<i>H. floribundum</i>	Rhodanthe (<i>Synachyrum</i>) <i>floribunda</i> (DC.) Wilson
<i>H. forrestii</i>	Rhodanthe (<i>Achyroclinoides</i>) <i>forrestii</i> (F. Muell.) Wilson
<i>H. frenchii</i>	Rhodanthe (<i>Actinaria</i>) <i>frenchii</i> (F. Muell.) Wilson
<i>H. fuscescens</i>	Rhodanthe (<i>Leiochrysum</i>) <i>fuscescens</i> (Turcz.) Wilson
<i>H. gracile</i>	<i>Erymophyllum tenellum</i> (Turcz.) Wilson
<i>H. haigii</i>	Rhodanthe (<i>Achyroclinoides</i>) <i>haigii</i> (F. Muell.) Wilson
<i>H. heteranthum</i>	Rhodanthe (<i>Helipteridium</i>) <i>heterantha</i> (Turcz.) Wilson
<i>H. humboldtianum</i>	Rhodanthe (<i>Leiochrysum</i>) <i>humboldtiana</i> (Gaudich.) Wilson
<i>H. hyalospermum</i>	<i>Hyalosperma glutinosum</i> Steetz subsp. <i>glutinosum</i>
<i>H. involucratum</i>	<i>Erymophyllum ramosum</i> (A. Gray) Wilson subsp. <i>involucratum</i> (F. Muell.) Wilson
<i>H. jessenii</i>	<i>Hyalosperma semisterile</i> (F. Muell.) Wilson
<i>H. laeve</i>	Rhodanthe (<i>Achyroclinoides</i>) <i>laevis</i> (A. Gray) Wilson
<i>H. manglesii</i>	Rhodanthe (<i>Rhodanthe</i>) <i>manglesii</i> Lindley
<i>H. margarethae</i>	Rhodanthe (<i>Actinaria</i>) <i>margarethae</i> (F. Muell.) Wilson
<i>H. maryonii</i>	Rhodanthe (<i>Monencyanthes</i>) <i>maryonii</i> (S. Moore) Wilson
<i>H. microglossum</i>	Rhodanthe (<i>Leiochrysum</i>) <i>microglossa</i> (Maiden & Betch.) Wilson
<i>H. molle</i>	<i>Leucochrysum molle</i> (Cunn. ex DC.) Wilson
<i>H. moschatum</i>	Rhodanthe (<i>Monencyanthes</i>) <i>moschata</i> (Cunn. ex DC.) Wilson
<i>H. niveum</i>	Distinct genus; affinities with <i>Helichrysum obtusifolium</i> Sond.
<i>H. oppositifolium</i>	Rhodanthe (<i>Leiochrysum</i>) <i>oppositifolia</i> (S. Moore) Wilson
<i>H. polycephalum</i>	Rhodanthe (<i>Achyroclinoides</i>) <i>polycephala</i> (A. Gray) Wilson
<i>H. polygalifolium</i>	Rhodanthe (<i>Leiochrysum</i>) <i>polygalifolia</i> (Cunn. ex DC.) Wilson
<i>H. polyphyllum</i>	Rhodanthe (<i>Polyphyllum</i>) <i>polyphylla</i> (F. Muell.) Wilson
<i>H. praecox</i>	<i>Hyalosperma praecox</i> (F. Muell.) Wilson
<i>H. propinquum</i>	Rhodanthe ((<i>Leiochrysum</i>) <i>propinqua</i> (W. Fitzg.) Wilson
<i>H. pterochaetum</i>	<i>Chrysocephalum pterochaetum</i> F. Muell.
<i>H. pygmaeum</i>	Rhodanthe (<i>Leiochrysum</i>) <i>pygmaea</i> (DC.) Wilson
<i>H. pyrethrum</i>	Rhodanthe (<i>Anisolepis</i>) <i>pyrethrum</i> (Steetz) Wilson
<i>H. roseum</i>	Rhodanthe (<i>Leiochrysum</i>) <i>chlorocephala</i> subsp. <i>rosea</i> (Hook.) Wilson

<i>H. rubellum</i>	Rhodanthe (<i>Leiochrysum</i>) <i>rubella</i> (A. Gray) Wilson
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<i>H. splendidum</i>	Rhodanthe (<i>Leiochrysum</i>) <i>chlorocephala</i> subsp. <i>splendida</i> (Hemsley) Wilson
<i>H. sterilescens</i>	Rhodanthe (<i>Synachyrum</i>) <i>sterilescens</i> (F. Muell.) Wilson
<i>H. stipitatum</i>	<i>Leucochrysum stipitatum</i> (F. Muell.) Wilson
<i>H. stoveae</i>	<i>Hyalosperma stoveae</i> (D.A. Cooke) Wilson
<i>H. strictum</i>	Rhodanthe (<i>Leiochrysum</i>) <i>stricta</i> (Lindley) Wilson
<i>H. stuartianum</i>	Rhodanthe (<i>Synachyrum</i>) <i>stuartiana</i> (Sond.) Wilson
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<i>H. tietkensii</i>	Rhodanthe (<i>Achyroclinoides</i>) <i>tietkensii</i> (F. Muell.) Wilson
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<i>H. uniflorum</i>	Rhodanthe (<i>Monencyanthes</i>) <i>uniflora</i> (J. Black) Wilson
<i>H. venustum</i>	<i>Hyalosperma glutinosum</i> Steetz subsp. <i>venustum</i> (S. Moore) Wilson
<i>H. zacchaeus</i>	<i>Hyalosperma zacchaeus</i> (S. Moore) Wilson

The classification of Australian species currently included in *Helipterum* (Asteraceae: Gnaphalieae): Part 2 *Leucochrysum*

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Abstract

Wilson, Paul G. The classification of Australian species currently included in *Helipterum* (Asteraceae: Gnaphalieae): Part 2 *Leucochrysum*. Nuytsia 8(3): 439-446 (1992). A new endemic Australian genus, *Leucochrysum* (DC.) Paul G. Wilson, is described to accommodate *Helipterum stipitatum*, *H. fitzgibbonii*, and most of the taxa previously referred to the *H. albicans* group. New combinations are effected to accommodate the five species and five infraspecific taxa.

Introduction

The application of the name *Helipterum* DC. was discussed in a previous paper (Wilson 1989), while the fact that it is an unnatural genus as currently circumscribed has been indicated by a number of workers in the group (e.g. Hilliard & Burt 1981, Anderberg 1989, 1991, Wilson 1989). In this paper I have segregated from *Helipterum* some species that are closely related to each other and that I consider to be clearly generically distinct from other species currently included in *Helipterum* or *Helichrysum*, or in any of the genera recently separated from them. Since this paper is a precursor to a treatment in the Flora of Australia, and since only new combinations are involved, descriptions are not provided for the specific or infraspecific taxa.

Historical

When discussing the rationale for accepting the as then unpublished name *Helipterum*, that had been proposed in litt. by Augustin de Candolle, Benth (1837) suggested that *Helichrysum cotula* Benth., *H. anthemoides* Spreng., and possibly *H. incanum* Hook., should be placed in *Helipterum*, either treating it as a section of *Helichrysum* or as a new genus. De Candolle (1838) subsequently published the name *Helipterum* as a genus and partly followed Benth's suggestion of species affinities by placing *H. incanum* and *H. cotula* in his new section *Leucochrysum* along with two other species that are now recognised (Wilson 1960) as being conspecific with *H. incanum*. Benth (1867) placed these species and a number of others, including *H. stipitatum*, in *Helipterum* sect. *Euhelipterum*. Subsequent Australian botanists have included in *Helipterum*, without reference to a

section, all the species here placed in *Leucochrysum*. Recently Anderberg (1991) noted that most of the Australian species of *Helipterum* should be placed in *Rhodanthe* Lindley but he indicated that 'a group of five species including *H. fitzgibbonii*, *H. albicans*, *H. stipitatum*, *H. molle*, and *H. saxatile* share a number of apomorphic features with the genus *Waitzia*' and 'deserve to be considered in an overall study of the species of the *Waitzia* generic group.' I agree with Anderberg's assessment of relationships (except that I exclude *H. saxatile*) and recognise the close affinity between *Waitzia* and *Leucochrysum*.

Generic affinities

The genus *Leucochrysum* differs from other Australian species-groups in *Helipterum* in having stipe-like claws to the involucre bracts (Figure 1A), a glabrous, translucent two-layered pericarp (Short *et al.* 1989, Figures 7b, 11c), a firm testa that is distinct from the pericarp, straight firm anther tails, and a broad deltoid or broad ovoid style apex with a thick vascular strand that forms a club-shaped mass in the tip (Figure 1G). Short *et al.* (1989) in a discussion on the fruit anatomy of various members of the Australian Gnaphalieae noted that the achene anatomy of *Helipterum albicans* differed from other members of *Helipterum* that had been studied and suggested that it and its close relatives should be recognised as a distinct genus.

The capitula of the *Leucochrysum* species resemble those found in a number of Australian species currently placed in *Helichrysum*, such as *Helichrysum elatum* DC., *H. boormanii* Maiden & Betche, and *H. collinum* DC. that form part of the section *Blepharolepis*. These species also have a terete claw to the involucre bracts; however, the species differ in having a pericarp with paired myxogenic cells that are formed by a periclinal division (anticlinal in other species-groups), a thin smooth testa with narrow-oblong thin-walled cells, a rounded to long-acuminate style apex with a slender vascular strand that terminates below the apex, an anther appendage with thick-walled cells, barbellate pappus bristles (shortly plumose in *Leucochrysum*), and undivided stereome to the involucre bracts.

The indumentum, involucre, corolla, anthers, and style of *Leucochrysum* (see below) are morphologically similar to those found in *Waitzia* and it is to this genus that *Leucochrysum* is most closely related, as has been recognised by Anderberg (see above).

The species of *Waitzia s.str.* (Wilson 1992) differ in having an elongated neck to the achene, 2-celled achenial papillae in which the lower cell overtops the upper, and pappus bristles that are barbellate and are shed as a unit from the achene. They also have branched stems with the capitula terminating the lateral branches.

In a treatment of the *Helipterum albicans* group (Wilson 1960) the superficially similar species *Helipterum saxatile* was described. It is not here included in the *Helipterum albicans* group since it differs in having concavo-convex claws to the involucre bracts, a slender cylindrical corolla with strongly undulate thickened cell walls of the inner epidermis and vascular strands extending to the apex of the lobes, a pericarp with papillose paired (by anticlinal division) slime cells, a small rounded style apex, and lanceolate anther appendages with thick cell walls. It is apparently related to *Helichrysum podolepidium* F. Muell. [*Chrysocephalum podolepidium* (F. Muell.) Anderberg] whose taxonomic position in relation to genera in the *Helipterum* complex will be discussed in a separate paper.

Taxonomic treatment

Leucochrysum (DC.) Paul G. Wilson, gen. et comb. nov.

Helipterum sect. *Leucochrysum* DC., Prod. 6:215(1838). *Lectotype* (here chosen): *Helipterum albicans* (Cunn.) DC. (see below).

Annual or perennial erect herbs branching at or above the base, sparsely to densely glandular stipitate on branches and leaves, frequently woolly. Leaves alternate, simple, entire, slender terete to oblong or obovate. Capitula solitary on slender leafless peduncles arising from apex of branches. Involucre hemispherical; intermediate bracts with terete glandular stipe-like claws and petaloid laminae; innermost two series with linear \pm flat claws and very small laminae; the outer bracts in some species sessile. Receptacle flat, epaleate. Florets bisexual, actinomorphic. Corolla tubular below, narrowly turbinate or narrowly cup-shaped above, shortly 5-lobed, very sparsely puberulous; vascular strand terminating below lobes. Anther appendage ovate, cells narrow-oblong, walls somewhat thickened; marginal cells differentiated; anther tails firm, slightly branched at ends. Style apex deltoid or broad-ovate, the vascular strand thick and clavate in the apex. Achene ellipsoidal; surface prominently undulate or plane; carpopodium very short, 1 cell high; pericarp thick, 2-layered, glabrous, translucent, cells linear, vascular strands laterally placed with respect to cotyledons; testa free from pericarp, somewhat thick, epidermal cells \pm equilateral or oblong, with straight walls; vascular strand laterally placed terminating in tip of seed. Pappus bristles equal to corolla, broad and weakly connate at base, shortly plumose with acute cilia, eventually breaking shortly above base.

Five species endemic to temperate Australia. For distribution notes on taxa other than *L. stipitatum* see Wilson (1960).

Note 1. De Candolle included the following species in his section *Leucochrysum*: *Helipterum incanum* (Hook.) DC., *H. bicolorum* DC., *H. albicans* (Cunn.) DC., and *H. cotula* (Benth.) DC. The first three taxa are now considered to be conspecific and are referred here to *Leucochrysum albicans* while *H. cotula* is now (Wilson 1989) treated as a member of the genus *Hyalosperma*. In the sectional description de Candolle stated that the involucre bracts were stipitate: this is correct for *H. albicans* but not for *H. cotula* and for this reason it would be inappropriate to designate the latter as lectotype.

Note 2. The concept that Bentham (1837) validly published the name *Helichrysum* sect. *Helipterum*, basing it on *Helichrysum cotula* Benth., *H. anthemoides* Spreng., and (with doubt) *H. incanum* Hook. is discussed by Wilson (1989) but not accepted.

Key to species

1. Stem much branched, the lateral branches terminating in capitula; outer bracts dark reddish brown, not needle-like *L. fitzgeraldii*
1. Stem branched only near base; peduncles long and arising from near base of plant; outer bracts pale or needle-like
 2. Outer involucre bracts needle-like *L. stipitatum*
 2. Outer involucre bracts with an obvious flattened lamina

3. Leaves filiform, tightly revolute, congested, glabrescent *L. graminifolium*
3. Leaves oblong or obovate or, if filiform, not tightly revolute, congested or loosely arranged along stem, woolly
4. Plant annual; lamina of intermediate involucre bracts broad-ovate to suborbicular, pale yellow; leaves linear to narrow-oblong or narrow-obovate *L. molle*
4. Plant perennial; lamina of intermediate involucre bracts very narrow-obovate to obovate, if deltate then with red streaks *L. albicans*

***Leucochrysum albicans* (Cunn.) Paul G. Wilson, comb. nov.**

Helichrysum albicans Cunn. in Field, Geog. Mem. New South Wales 359(1825) '*Elichrysum*'. - *Helipterum albicans* (Cunn.) DC., Prod. 6:215(1838). - *Argyrocome albicans* (Cunn.) Kuntze, Revis. Gen. Pl. 1:308(1891). - *Roccardia albicans* (Cunn.) Voss, Vilm. Blumeng. ed. 3, 1:532(1895). *Lectotype*: Forest Land, Cox's River, 9 Oct. 1822, A. Cunningham 71 (K, ?iso: MEL) *fide* Wilson (1960).

Helichrysum incanum Hook., Bot. Mag. t. 2881(1829). - *Aphelexis incana* (Hook.) G. Don in Sweet, Hort. Brit. ed. 3, 379(1839). *Lectotype*: *op. cit.* t. 2881, *fide* Wilson (1960).

Helipterum incanum DC., Prod. 6:215(1838). *Type*: Van diemen, R.C. Gunn 108, comm. Lindley in 1834 (holo: G-DC, photo seen), *nom. superfl.*

Helipterum bicolorum Cunn. ex DC., Prod. 6:215(1838). *Lectotype*: Hills of the Lachlan River, 31 July 1817 (holo: G-DC, photo seen) *fide* Wilson (1960).

Key to infraspecific taxa

1. Leaves obovate, densely woolly subsp. *alpinum*
1. Leaves filiform to narrow-oblong or narrow-obovate, thin, moderately woolly subsp. *albicans*
2. Inner involucre bracts white var. *tricolor*
2. Inner involucre bracts yellow
3. Intermediate involucre bracts ovate to oblong, obtuse to acute var. *albicans*
3. Intermediate involucre bracts broadly ovate to deltate or orbicular, acute var. *buffaloensis*

subsp. *albicans*

var. *albicans*

Helipterum incanum var. *flavidiceps* F. Muell., Rep. Pl. Babbage's Exped. 14(1859). *Lectotype*: Subalpine plains on the Snowy River, F. Mueller (K, iso: MEL) *fide* Wilson (1960).

Helipterum incanum var. *auriceps* F. Muell., Rep. Pl. Babbage's Exped. 14(1859). Type citation: 'In many of the arid plains and mountains of Australia Felix and in the northern parts of South Australia'. *Lectotype* not designated.

Helipterum incanum var. *filifolium* F. Muell., Rep. Pl. Babbage's Exped. 14(1859). *Lectotype*: Station Peak, You Yangs Mts, Victoria, *F. Mueller* (MEL, iso: K) *fide* Wilson (1960).

var. **buffaloensis** (Paul G. Wilson) Paul G. Wilson, comb. nov.

Helipterum albicans var. *buffaloensis* Paul G. Wilson, Trans. Roy. Soc. South Austral. 83:170(1960). *Type*: Mt Buffalo, Victoria, 10 Nov. 1955, *E. Gauba* (holo: GAUBA).

var. **tricolor** (DC.) Paul G. Wilson, comb. nov.

Helipterum incanum var. *tricolor* DC., Prod. 6:215(1838), *Type*: based on *Helichrysum incanum* Hook.

Helichrysum incanum Hook., Bot. Mag. t. 2881(1829). - *Helipterum albicans* var. *incanum* (Hook.) Paul G. Wilson, Trans. Roy. Soc. South Austral. 83:170(1960).

Helipterum incanum DC., Prod. 6:215(1838), *nom. superfl.*

Helipterum bicolorum DC., Prod. 6:215(1838). - *Roccardia albicans* f. *bicolorum* (DC.) Voss, Vilm. Blumeng. ed. 3, 1:532(1895). *Type*: see above.

Helipterum incanum var. *purpureo-album* F. Muell., Rep. Pl. Babbage's Exped. 14(1859). - *H. albicans* f. *purpureo-album* (F. Muell.) Paul G. Wilson, Trans. Roy. Soc. South Austral. 83:172(1960). *Lectotype*: Maneroo Plains, 1855, *F. Mueller* (MEL), *fide* Wilson *l.c.*

Helipterum albicans f. *grampianum* Paul G. Wilson, *op. cit.* 172. *Type*: Skipton Plains, 1860, *W.J. Whan* 39 (holo: MEL; iso: NSW).

subsp. **alpinum** (F. Muell.) Paul G. Wilson, comb. nov.

Helipterum incanum var. *alpinum* F. Muell., Rep. Pl. Babbage's Exped. 14(1859). - *H. albicans* subsp. *alpinum* (F. Muell.) Paul G. Wilson, *op. cit.* 174. *Type*: Summit of the Australian Alps, *F. Mueller* (holo: MEL; iso: K, NSW).

Note: When revising the *Helipterum albicans* complex (Wilson 1960), I assumed that *Helipterum incanum* DC. (1838) represented a new combination based on *Helichrysum incanum* Hook. (1829), a name that de Candolle had placed in synonymy under *Helipterum incanum* var. *tricolor* DC. After discussion with my colleague Gillian Perry I have decided that this assumption was incorrect. I now consider that *Helipterum incanum* DC. was published as a new species; the name was, however, superfluous and illegitimate since a previously published species name was cited under one of its varieties (i.e. under var. *tricolor*). The epithet var. *tricolor* is therefore legitimate but it does not create the autonym 'var. *incanum*' since the species name to which it was applied was not legitimate. The epithet var. *tricolor* therefore has priority over its synonym var. *incanum* (Hook.) Paul G. Wilson (1960).

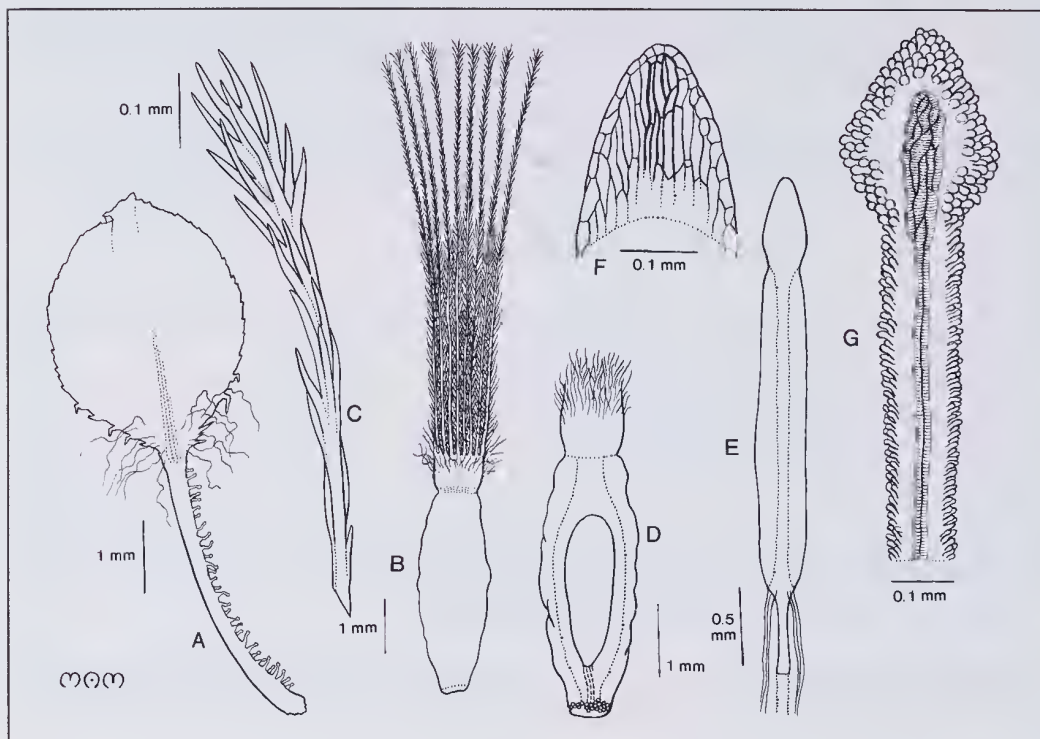


Figure 1. *Leucochrysum stipitatum*. A - Intermediate involucre bract. B - Achene with pappus. C - Apex of pappus bristle. D - Achene after pappus bristles have broken near base. E - Anther. F - Terminal portion of anther appendage. G - Style branch and apex showing thick vascular strand. From H. Demarz 2786.

***Leucochrysum fitzgibbonii* (F. Muell.) Paul G. Wilson, comb. nov.**

Helipserum fitzgibbonii F. Muell. Victorian Nat. 7:38 (July 1890); Trans. & Proc. Roy. Soc. South Australia 13:170 (Dec. 1890); Bot. Centralbl. 43:276(1890), *op.cit.* 45:122(1891). Type citation: 'Tempe Downs, R. Thornton; near Georgina-River, Alfr. Henry; Finke-river, Rev. H. Kempe; Lady Charlotte's Waters and west of Eringa, W. Tietkens; Nullarbor-Plains, J. Batt; Mount Moore, Edwin Merrall; remotest eastern sources of Swan-River, Miss Alice Eaton.' *Lectotype* (here chosen): Finke River, *Kempe* 408 (MEL 110456).

Distribution. Central Western Australia, far north South Australia, and southern Northern Territory.

***Leucochrysum graminifolium* (Paul G. Wilson) Paul G. Wilson, comb. nov.**

Helipserum albicans var. *graminifolium* Paul G. Wilson, Trans. Roy. Soc. South Austral. 83: 171 (1960). *Type:* Clarence-Wolgan Road, New South Wales, 26 Feb. 1939, W.F. Blakely, J. and W.J. Buckingham 3306 (holo: NSW; iso: AD).

This species is evidently found on sandstone cliffs in a small area c. 40 km north of Lithgow in New South Wales.

Although very similar to narrow-leaved variants of *L. albicans* it differs significantly in its almost silky indumentum, in its tightly revolute leaves that (unlike those of *L. albicans*) lack chlorenchymatous tissue beneath the thickened midrib, and in having 2-celled myxogenic papillae on the achene (these absent in *L. albicans*).

***Leucochrysum molle* (Cunn. ex DC.) Paul G. Wilson, comb. nov.**

Helichrysum molle A.Cunn. ex DC., Prod. 6:194(1838). - *Helipterum molle* (Cunn. ex DC.) Paul G. Wilson, Trans. Roy. Soc. South Austral. 83:175(1960). - *Gnaphalium molle* (Cunn. ex DC.) Schultz-Bip., Bot. Zeitung (Berlin) 3:171(1845) *nom. illeg.* *Lectotype*: Molle's Plains, Lachlan River, New South Wales, July 1817, A. Cunningham (G-DC photo seen) *fide* Wilson (1960).

Waitzia brachyrrhyncha F. Muell., Linnaea 25:407 (April 1853). - *Helipterum brachyrrhynchum* (F. Muell.) Sonder, Linnaea 25:517 (June 1853). - *Helichrysum brachyrrhynchum* (F. Muell.) Baillon, Dict. Bot. 3:27(1891). - *Roccardia albicans* f. *brachyrrhyncha* (F. Muell.) Voss, Vilm. Blumeng. 3rd edn, 1:532 (1895). *Lectotype*: Cudnaka, South Australia, F. Mueller (MEL) *fide* Wilson (1960).

Helipterum incanum var. *brachylepis* F. Muell., Rep. Pl. Babbage's Exped. Type citation: 'Flinders Ranges, &c.' *Lectotype* (here chosen): Cudnaka, F. Mueller (MEL, holotype of *Waitzia brachyrrhyncha*).

***Leucochrysum stipitatum* (F. Muell.) Paul G. Wilson, comb. nov. (Figure 1)**

Helipterum stipitatum (F. Muell.) Benth., Fl. Austral. 3:643(1867). - *Helichrysum stipitatum* F. Muell., Fragm. 3:133(1863). - *Argyrocome stipitata* (F. Muell.) Kuntze, Revis. Gen. Pl. 1:309 (1891). *Type*: Finke River, Central Australia, J. Macd. Stuart (holo: MEL 110722).

Distribution. Central Western Australia east to central and northern South Australia, southern Northern Territory, and south west Queensland.

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The classification of some Australian species currently included in *Helipterum* and *Helichrysum* (Asteraceae: Gnaphalieae): Part 3 *Anemocarpa* and *Argentipallium*, two new genera from Australia

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Abstract

Wilson, Paul G. The classification of some Australian species currently included in *Helipterum* and *Helichrysum* (Asteraceae: Gnaphalieae): Part 3 *Anemocarpa* and *Argentipallium*, two new genera from Australia. Nuytsia 8(3): 447-460 (1992). Two new genera *Anemocarpa* and *Argentipallium* are described in the Gnaphalieae: Angianthinae. The first genus is based on a new species *Anemocarpa calcicola* from Western Australia and includes two other species: *A. podolepidium* [*Helichrysum podolepidium* F. Muell.], and *A. saxatilis* [*Helipterum saxatile* Paul G. Wilson]; it is apparently most closely related to the genera *Leucochrysum* (DC.) Paul G. Wilson and *Chrysocephalum* Walp. The second genus is based on *Argentipallium obtusifolium* (Sonder) Paul G. Wilson [*Helichrysum obtusifolium* Sonder] and includes five other species: *A. blandowskianum* [*Helichrysum blandowskianum* Sonder], *A. dealbatum* [*Helichrysum dealbatum* Labill.], *A. niveum* [*Helipterum niveum* Steetz], *A. spiceri* [*Helichrysum spiceri* F. Muell.], and *A. tephrodes* [*Ozothamnus tephrodes* Turcz.]; it is evidently most closely related to *Ozothamnus* R.Br.

Introduction

The circumscription of the genera *Helipterum* DC. and *Helichrysum* Miller in Australia has been discussed in several recent papers (Hilliard & Burtt 1981, Wilson 1989, Anderberg 1991), where it has been demonstrated that these genera, in the strict sense, do not occur in Australia and that the Australian species previously included in them should be placed in a number of distinct genera. Anderberg, *op. cit.*, further indicated that the genera *Lawrencella* Lindley and *Rhodanthe* Lindley were polyphyletic as circumscribed in his treatment and needed further study.

In this paper I am describing two new genera. The first, *Anemocarpa*, includes one species placed by Anderberg in the '*Rhodanthe*' assemblage and one placed by him in *Chrysocephalum* Walp. The second, *Argentipallium*, contains six species, four of which were placed by Anderberg in the *Lawrencella* '*Scorpioides*' complex. Prior to Anderberg's assessment the species involved in the two new genera had been treated as belonging to either *Helichrysum* or *Helipterum*. Eventually it is probable that further species currently placed in *Helichrysum* will be transferred to one or other of the new genera. The correct circumscription and nomenclature of these additional species has still

to be elucidated, a task that will entail further research and will involve the study of material in Australian and overseas herbaria; for these reasons only those species are treated whose names are required in regional floras and whose taxonomy and nomenclature is clear.

Methods

Dissections of achenes, florets, and involucre bracts of representative Australian species of '*Helipterum*', '*Helichrysum*', and of related genera have been mounted in Hoyer's solution (King & Robinson 1970) and examined under the stereo and high-powered microscope. Achenes have also been embedded in Spurr's low-viscosity embedding media and sections stained in Toluidine Blue. In addition microscope slides were studied of transverse sections of achenes, some of which were prepared by P.S. Short, K.E. Wilson and J. Nailon for their paper (1989) on achene anatomy while others were prepared for me by my colleagues R. Cranfield and C. Parker.

Morphological studies

The morphological characters used in discriminating the genera and species have been described (or references given to their description) in a number of earlier papers (e.g. Wilson 1989, 1992b); supplementary notes are here provided on some of these characters.

Achenial hairs. The nature of the hairs or papillae on the achenes was studied. Various types of hairs and papillae found in the Gnaphalieae have been described by Anderberg (1991) and their taxonomic significance assessed. In the '*Helichrysum elatum*' group an additional 'papilla' type has been observed, in this two cells of the pericarp epidermis are laterally instead of vertically placed; they are transparent and often myxogenic. Papillae of this type are referred to as 2-celled fenestrac*. In some species of this group the fenestrae apparently consist of only one longitudinally elongated cell, this cell is usually not myxogenic and is not raised above the surface of the achene.

In *Anemocarpa* low, rounded, 2-celled papillae are present with the lower cell slightly exceeding the upper. This papilla type, which was described by Anderberg (1991), is comparable to that found in the *Waitzia* group of genera.

In *Argentipallium* short narrow-obovoid duplex hairs are present; these are similar to the more elongated duplex hair type that is found in *Ozothamnus*.

Achenial nervation. The vasculature of the achene can be determined by mounting it in Hoyer's solution. Where the testa is free from the pericarp, or where it can be readily separated from it, the vasculature is preferably examined in an achene in which the seed (i.e. testa, endosperm, and embryo) has been removed. In all Australian members of the Gnaphalieae where this organ has been studied, with the exception of *Myriocephalus guerinae* F. Muell. (see Short *et al.* 1989), there are two vascular strands in the pericarp. In the testa there is always one strand and this passes for a varying degree longitudinally around the seed; it is best observed by studying a whole mount of the testa from which the embryo and endosperm (which is usually \pm free from the testa) have been removed.

* This 'papilla' type is also found in *Bracteantha* as is noted by E.E. Georgeadou Tvrtkovic-Sahin (1982) who refers to them as '2-celled idioblasts'. It is anticipated that these will be more fully described, and their taxonomic significance assessed by her in a forthcoming paper.

The position of the vascular strands of the testa and pericarp relative to the cotyledons of the embryo is of generic significance (Short *et al. op. cit.*) and may be determined by examining transverse sections of the achene, by examining cleared whole mounts (if these are sufficiently transparent), or by dissecting the achene. Their position has been observed in representative species of all of the genera or species-groups discussed in this paper.

In *Anemocarpa* the achenial vascular strands are laterally placed in relation to the cotyledons as they are in its putative closest relatives *Waitzia* Wendl. and *Leucochrysum* (DC.) Paul G. Wilson. They are also laterally placed in species of the *Helichrysum elatum* group.

In *Argentipallium* the vascular strands are medially placed, which is also the case in *Ozothamnus* R.Br.

Involucral bracts. The cartilaginous basal portion of the involucral bracts, the stereome, was first critically described by Drury (1970). He pointed out that in some genera the stereome is not entire and that unthickened translucent areas, here referred to as 'fenestrae', are present between the thickened opaque regions. This character has been used by Hilliard and Burt (1981) and by Anderberg (1991) to assist in the segregation of species into discrete genera in the *Gnaphalium* - *Helichrysum* complex. The Australian species of this complex are also amenable to this procedure. The species of the genus *Argentipallium* have fenestrate stereomes whereas species of *Anemocarpa* and of the *Helichrysum elatum* group do not. In the genus *Ozothamnus*, as currently circumscribed (Anderberg 1991), some species appear to have fenestrate stereomes while others do not.

Pappus. In *Anemocarpa* the pappus bristles are free and persistent but they eventually break c. 1 mm above the base in the same manner as do the bristles in species of the *Helichrysum elatum* group and of *Leucochrysum*. The bristles are barbellate upwards with the terminal barbellae congested and prominent but not thickened.

In *Argentipallium* the bristles are very shortly united, are persistent, and do not break above base. They are barbellate upwards with the terminal barbellae clavate and thickened. This situation is similar to that found in *Ozothamnus*.

Mycorrhizal associations. It has been shown by Wareup (1990) that only about half of the Australian species that had been previously included in either *Helipterum* or *Helichrysum* form ectomycorrhiza. Wareup pointed out that this was unusual since, in general, species of a composite genus are usually either all ectomycorrhizal or all non-ectomycorrhizal. However, when the species are segregated into the genera recognised by Anderberg (1991) and by myself these segregate genera have so far been found to contain only ectomycorrhizal or only non-ectomycorrhizal species. Unfortunately only a few species involved in the present study have been tested.

Helichrysum podolepidium F. Muell. (*Anemocarpa*) was found not to form ectomycorrhiza. This contrasts with species in the putatively closely related genera *Leucochrysum* and *Waitzia* that form ectomycorrhiza. It also contrasts with species of *Chrysocephalum* in which genus *H. podolepidium* was placed by Anderberg (1991).

Helichrysum dealbatum Labill. and *H. blandowskianum* Sonder (both *Argentipallium*) form ectomycorrhiza, while species in the morphologically similar genus *Ozothamnus* do not.

Generic studies

In a recent paper Anderberg (1991) recognised the genera *Chrysocephalum* Walp., *Bracteantha* Anderb., *Ozothamnus* R.Br., and *Lawrencella* Lindley *sensu lato* as segregates of (Australian) *Helichrysum*. I have reclassified the taxa in the *Lawrencella* complex (Wilson 1992a) and most of the Australian representatives of *Helipterum* (Wilson 1992a,b). This leaves a number of Australian species of *Helichrysum* and of *Helipterum* that still require generic classification; they are as follows:-

1) The '*Helichrysum elatum*' group. Species in which the involucre bracts have terete or semi-terete stipes and are not fenestrate, the anther apicula have thick cell walls, the style appendages are ovate to acuminate, and the achenes are glabrous with a smooth crustaceous pericarp in which the vascular strands are laterally positioned. The epicarp has longitudinal 2-celled fenestrae (idioblasts) of the *Bracteantha* type. The group is represented by such species as *H. elatum* DC., *H. boormanii* Maiden & Betche, and *H. adenophorum* F. Muell. It corresponds to *Helichrysum* sect. *Blepharolepis* DC. *pro parte* and, from the few species investigated (Warcup 1990), is evidently not ectomycorrhizal.

2) The '*Helipterum saxatile*' group. Species similar in most characters to those in group 1 but with thin anther apicula, rounded style apex, and papillose achenes (the two cells of the papillae vertically positioned) with a thin pericarp. This group is represented by *Helipterum saxatile* Paul G. Wilson, *Helichrysum podolepidium* F. Muell., and an undescribed species. The species are here placed in the new genus *Anemocarpa*. It is possible that it will have to be enlarged to include species at present in group 1.

3) The '*Helichrysum dealbatum*' group. Species with a flattened claw to the involucre bracts, fenestrate stereome, thin anther apicula, truncate to rounded style apices, short clavate to obovoid duplex hairs on the achenes, a diaphanous pericarp, and a leathery testa, with the achenial vascular strands medially positioned. These species form ectomycorrhiza. To this group belong *Helichrysum dealbatum* Labill., *H. spiceri* F. Muell., *Ozothamnus tephrodes* Turcz., *Helichrysum obtusifolium* Sonder, and *Helipterum niveum* Steetz; they are here placed in the new genus *Argentipallium*.

4) *H. oligochaetum* F. Muell. This species appears to have no near relatives in the '*Helichrysum*' group and is possibly best placed in close association with *Rhodanthe*.

5) *Helichrysum pumilum* J.D. Hook. A species with the habit of *Leucochrysum albicans* (A.Cunn.) Paul G. Wilson but with florets similar to some species of *Rhodanthe* particularly in having villous achenes; it differs in having heterogamous capitula, thick branched anther tails, deeply stained corollas, and barbellate pappus bristles.

6) *Helichrysum leucopsideum* DC. A rhizomatous species with the appearance of certain species in the '*Helichrysum elatum*' group. Its florets are similar to those in *Bracteantha* but have a rounded style apex, a smooth glabrous cylindrical achene without fenestrae or myxogenic cells, and a double pappus that is persistent. The vascular strands of the pericarp and testa are medially orientated relative to the cotyledons whereas in *Bracteantha* they are laterally orientated (Short 1989). This is the only Australian species in the '*Helipterum* - *Helichrysum*' complex in which the pappus is double and it is the only species that is recorded as being rhizomatous.

Key to genera

The genera discussed in this paper may be distinguished by the following synoptic key:-

1. Annual herbs; involucre bracts with flattened proximal portion, stereome not fenestrate; anther appendage with proximal cells equilateral and thick-walled, distal cells narrow-oblong and thin-walled; style apex deltoid; pappus bristles evenly barbellate or cilia longer near base; achene villous or hispid with large thick duplex hairs; ectomycorrhiza absent *Lawrencella* group
2. Base of achene prominently excavated; vascular strands (v.s.) of pericarp and testa lateral
 3. Radiant petaloid involucre bracts absent; leaves terete, strictly basal *Bellida*
 3. Radiant petaloid involucre bracts present; leaves various, sub-basal or cauline *Lawrencella*
2. Base of achene minute, scarcely excavated; v.s. of pericarp and testa medial *Schoenia*
1. Perennial herbs or shrubs; involucre bracts with flattened or stipe-like proximal portion, fenestrate or not; anther appendage with proximal cells narrow-oblong and similar to distal cells; style apex truncate or rounded to acuminate; pappus bristles barbellate or plumose, smooth near base; achene glabrous, papillose, or with very small or weak duplex hairs; ectomycorrhiza present or absent
 4. Achenes with short clavate duplex hairs; pericarp thin, transparent, v.s. medial; involucre bracts papery, fenestrate; anther tails long and slender exceeding the collar; pappus persistent; ectomycorrhiza present; perennial herbs *Argentipallium*
 4. Achenes glabrous or minutely papillose, or with short slender duplex hairs; v.s. of pericarp medial or lateral; involucre bracts glumaceous or papery, not fenestrate; pappus persistent or caducous; ectomycorrhiza present or absent; shrubs or perennial herbs
 5. Shrubs; capitula small and clustered; involucre bracts papery; style apex truncate; achene with short narrow duplex hairs or glabrous, v.s. of pericarp medial; pappus persistent; ectomycorrhiza absent *Ozothamnus*
 5. Perennial herbs; capitula solitary or clustered; style various; achenes smooth or minutely papillose, v.s. of pericarp lateral; pappus persistent or caducous; ectomycorrhiza present or absent
 6. Intermediate involucre bracts with a flattened proximal portion; ectomycorrhiza present
 7. Achenes with papillae consisting of two cells of which the lower overtops the upper; involucre bracts papery, strongly ciliate; style apex truncate; pericarp cartilaginous; pappus persistent *Chrysocephalum*
 7. Achenes smooth and glabrous; involucre bracts glumaceous, entire; style apex acute; pericarp thick and hard; pappus caducous *Bracteantha*
6. Involucre bracts with a stipe-like proximal portion; pappus persistent; ectomycorrhiza present or absent

8. Pappus bristles barbellate; style apex rounded to acuminate, not deltoid; pericarp papery or brittle; ectomycorrhiza absent
9. Pericarp papery; style apex rounded; carpopodium prominent, several cells high *Anemocarpa*
9. Pericarp brittle; style apex ovate to acuminate; carpopodium minute, 1 cell high '*Helichrysum elatum*' group
8. Pappus bristles plumose; style apex broad-deltoid; pericarp thick, cartilaginous; carpopodium minute, 1 cell high; ectomycorrhiza present *Leucochrysum*

Anemocarpa Paul G. Wilson, gen. nov.

Herbae perennes, non-ectomycorrhizales, lanatae. Folia alterna, sessilia. Capitula solitaria. Involucrum hemisphericum. Bractee involucrales chartaceae, anguste ellipticae; bractee interioris parte inferiores semiterctibus, stereomate cefenestrato, superiores anguste ellipticae albae. Receptaculum convexum, epaleaceum, glabrum. Flosculi homogami, disciformes. Corolla anguste cylindrica sed versus apicem anguste turbinata, breviter 5-lobata, cellulis faucis undulatis. Caudae antherarum graciles sed firmac. Styli apex rotundatus, nervo prominenti fere ad apicem extenso. Achenium ellipsoideum, glabrum; pericarpum translucens, papillis 2-cellulis ornatum; testa membranacea, crystallina, nervo lateraliter posito; carpopodium multicelluloso altum. Pappi setae persistentes barbellatae, cellulis apicalibus acutis.

Typus: Anemocarpa calcicola Paul G. Wilson

Perennial herbs. Ectomycorrhiza not formed. Plant covered with a woolly indumentum. Leaves alternate, simple, entire, sessile. Capitula solitary and terminal to stems or branches, homogamous, disciform. Involucre hemispherical. Involucral bracts papery, narrow-elliptic; outer bracts pale brown without stipe; inner bracts with proximal portion semi-terete and stipe-like with thickened stereome, not fenestrate, distal portion a white papery lamina, the central vascular strand passing into the lamina; innermost bracts with a linear flattened proximal portion grading into a very short truncate lamina. Receptacle convex, epaleate, glabrous. Corolla narrow-cylindrical, narrow-turbinate towards the apex, regularly shortly 5-lobed, glabrous and smooth within, sparsely glandular pilose outside; cells of inner epidermis of throat undulate. Anther apiculum narrow-triangular; constituent cells narrow-oblong with thickened walls; tails slender, firm, \pm equal to narrow-oblong collar. Style apex rounded, shortly papillate; vascular strand prominent and extending to near tip. Achene ellipsoid, glabrous; pericarp diaphanous to papery and translucent, epidermis with 2-celled myxogenic papillae, the cells separated by a transverse wall, the lower cell slightly exceeding the upper; testa membranous, pale brown, adnate to pericarp, epidermal cells broad-oblong with straight walls, crystals present, vascular strand in lateral position (in relation to cotyledons) and not extending to apex of seed; carpopodium prominent, several cells high. Pappus bristles, free, persistent but eventually breaking c. 1 mm above base, equal to corolla, slender, smooth towards base, barbellate upwards, the terminal barbellae congested, prominent, and acute.

Etymology. The generic name is derived from the Greek words *anema*, without a thread, and *carpos*, fruit, with reference to the absence of hairs on the achenes.

This genus appears to be most closely related to *Leucochrysum*. It shares with that genus lateral vascular strands in the achene, a similar type of pappus, and similar involucre bracts. The genera differ from each other in the shape of the style apex, in the achene morphology (particularly the presence of a prominent carpodoid in *Anemocarpa*), in the presence of 2-celled papillae in *Anemocarpa* and their absence in *Leucochrysum*, and evidently also in their mycorrhizal status (Warcup 1990).

As is mentioned earlier, a number of species additional to those listed here will probably have to be transferred to this genus from *Helichrysum*. However, taxonomic studies on these species is continuing and will be the subject of a later paper. Only those species whose nomenclature and circumscription is clear are presently considered.

Key to species

- 1. Involucre lacking ray bracts *A. podolepidium*
- 1. Involucre with prominent white ray bracts
 - 2. Leaves mostly 5-7 mm long (south coast W.A.) *A. calcicola*
 - 2. Leaves mostly 20-40 mm long (central Australia) *A. saxatilis*

Anemocarpa calcicola Paul G. Wilson, sp. nov. (Figures 1, 2a)

Rami graciles. Folia anguste elliptica, 5-7(12) mm longa, lanata, parum crenulata, marginibus revoluta. Capitula hemispherica, ad 30 mm diam.; bractae exteriores ovatae, malvinae vel pallide bruneae; interiores lamina anguste elliptica, alba ad 12 mm longa.

Typus: 10 km north of Eyre, 32° 09' S, 126° 17' E, Western Australia, 1 Oct. 1984, *G.J. Keighery* 7533 (holo: PERTH; iso: CANB, K).

Erect perennial to 30 cm high and wide, with a white woolly indumentum on leaves and branches. Branches slender. Leaves cauline, alternate, sessile, narrowly elliptic, 5-7(12) mm long, sparse and small towards the capitula; margins revolute, slightly crenulate; upper surface sparsely woolly; lower surface densely woolly. Capitula hemispherical, to 30 mm diameter; outer bracts sessile, ovate, pale brown or tinged with mauve, inner with narrow elliptic white lamina to 12 mm long, spreading but not reflexed on semiterete claw. Florets numerous. Corolla c. 3 mm long; lobes deltoid c. 0.4 mm long. Anther loculi c. 1 mm long; apiculus c. 0.3 mm long. Achene ellipsoid, 1.5 mm long.

Specimens examined (selection only). WESTERN AUSTRALIA: 6 km north of Eyre, *Demarz* 9760; Baxters Cliffs south of Caiguna, 24 August 1983, *Fitzgerald*; Twilight Cove, *George* 8558; 2 km north-west of Toolina Rockhole, *Keighery & Alford* 635; Telegraph Pass, Hampton Scarp, *Newbey* 11762; Pt Dover, *Wilson* 5917. (All PERTH).

Distribution. Near the south east coast of Western Australia from Toolina Cove (125° E) to Eyre (126° 18' E).

Habitat. Sandy loam over limestone in mallee shrubland or coastal heath.

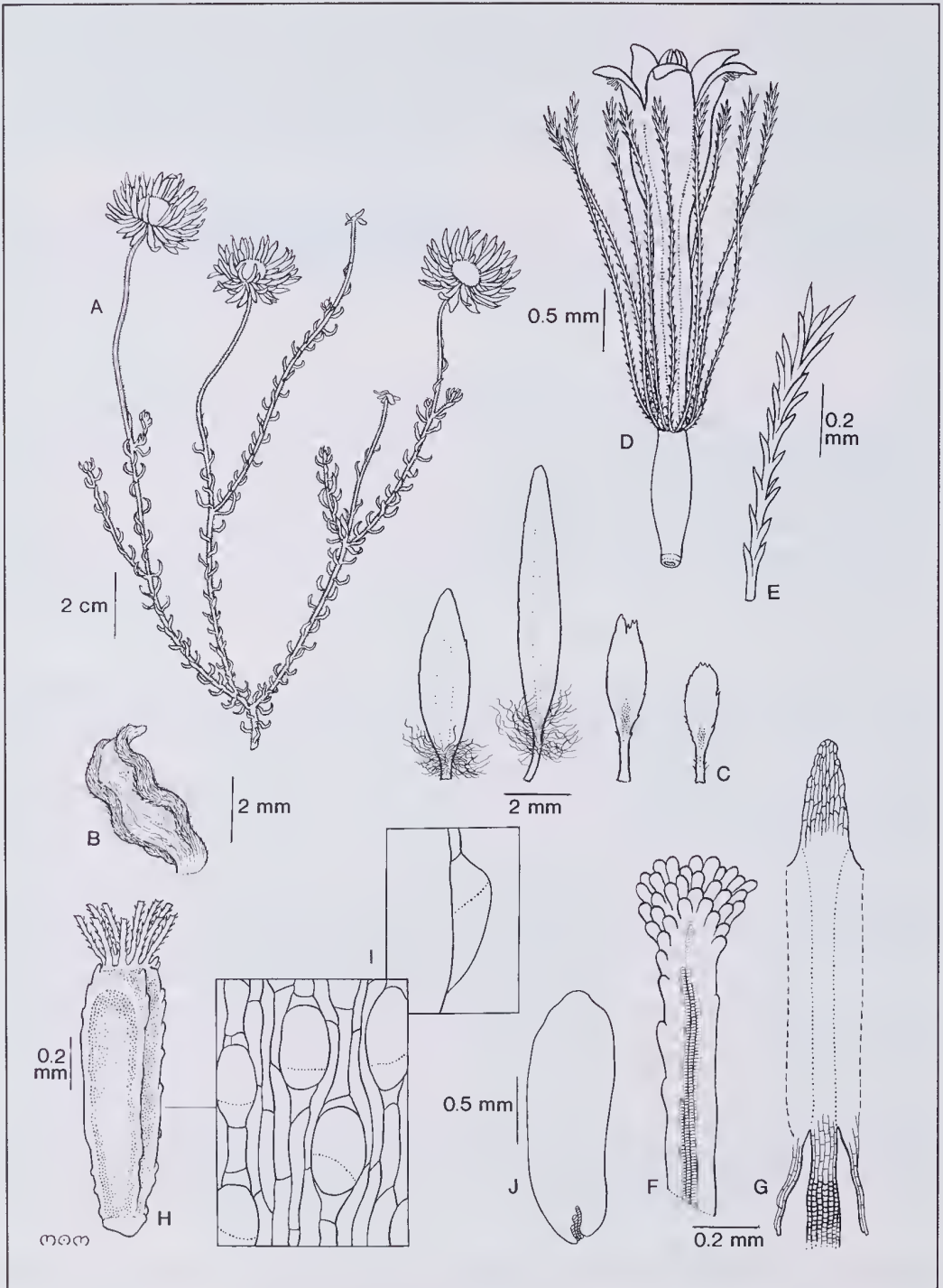


Figure 1. *Anemocarpa calcicola*. A - habit; B - leaf; C - outer, intermediate and inner involucre bracts; D - floret; E - apex of pappus bristle; F - style apex; G - anther; H - achene; I - surface and side views of pericarp showing myxogenic 2-celled papillae; J - seed showing vascular strand. From P.G. Wilson 7693.

Etymology. The specific epithet is derived from the Latin words *calx*, chalk, and *cola*, an inhabitant, with reference to the substrate over which the plant is found.

This species is superficially similar to and has been confused with *Argentipallium obtusifolium* (Sonder) Paul G. Wilson (as *Helichrysum obtusifolium* Sonder), from the latter it differs in the indumentum being woolly (not thick silky), in the involucrel bracts having a semi-terete stipe (not a flattened basal portion), in the lamina of the innermost bracts being very short and truncate (not large and similar to the inner bracts), in the achenes having low rounded 2-celled papillae (not short duplex hairs), and in the anther apiculum being narrow-triangular with thickened cells (not ovate with thin-walled cells). Whereas *Anemocarpa calcicola* is found in south-east Western Australia *Argentipallium obtusifolium* is found in southern eastern Australia to as far west as Eyre Peninsula.

Another superficially similar taxon that has been confused with *H. obtusifolium* is *Argentipallium niveum* (Steetz) Paul G. Wilson [*Helipterum niveum* Steetz]. It is found in the south-west of Western Australia and is readily distinguished from otherwise similar species by its axillary clusters of linear leaves.

Anemocarpa podolepidium (F. Muell.) Paul G. Wilson, comb. nov.

Helichrysum podolepidium F. Muell., Rep. Pl. Babbage Exped. 13(1859). - *Chrysocephalum podolepidium* (F. Muell.) Anderb., Op. Bot. 104:119(1991). *Type*: Wirrawirraloo, 31° 11' S, 136° 41' E, South Australia, 1858, B.H. Babbage.

Distribution. Found in southern Northern Territory, north-eastern South Australia, south-west Queensland, and north-west New South Wales.

Anemocarpa saxatilis (Paul G. Wilson) Paul G. Wilson, comb. nov.

Helipterum saxatile Paul G. Wilson, Trans. Roy. Soc. South Australia 83:166(1960). *Type*: Near Hermannsburg, 24 Aug. 1956, G. Chippendale 2632 (holo: NT; iso: CANB, NT).

Distribution. Found in southern Northern Territory, northern South Australia, south-west Queensland, and north-west New South Wales.

Argentipallium Paul G. Wilson, gen. nov.

Herbae perennes cum fungis in ectomycorrhiza consociatae, dense sericeae. Folia alterna integra sessilia, linearia vel elliptica. Capitula solitaria. Involucrum hemisphericum vel late turbinatum; bractae exteriores, chartaceae, anguste ellipticae; bractae interiores parte inferiores oblongo indurato, lamina chartacea anguste elliptica alba ornatae, stereomate fenestrato; bractae intimis interioribus similaribus. Receptaculum convexum epaleaccum glabrum. Flosculi homogami vel heterogami cum pauci flosculi feminei, disciformes. Corolla anguste cylindrica vel supra anguste turbinata, 5-lobata. Caudae antherarum graciles, debiles vel firmae. Styli apex truncatus vel rotundatus. Achenium anguste cylindricum, laeve, pilis brevissimis obovoideis ornatum; pericarpium diaphanum; testa membranacea palido brunca, nervo in posito laterali ad apicem seminis extenso. Pappi setae ad basim coneretae, ± persistentes, barbellatae, in flosculis femineis paucae vel absentes, barbellis ad apicem plerumque clavatis.

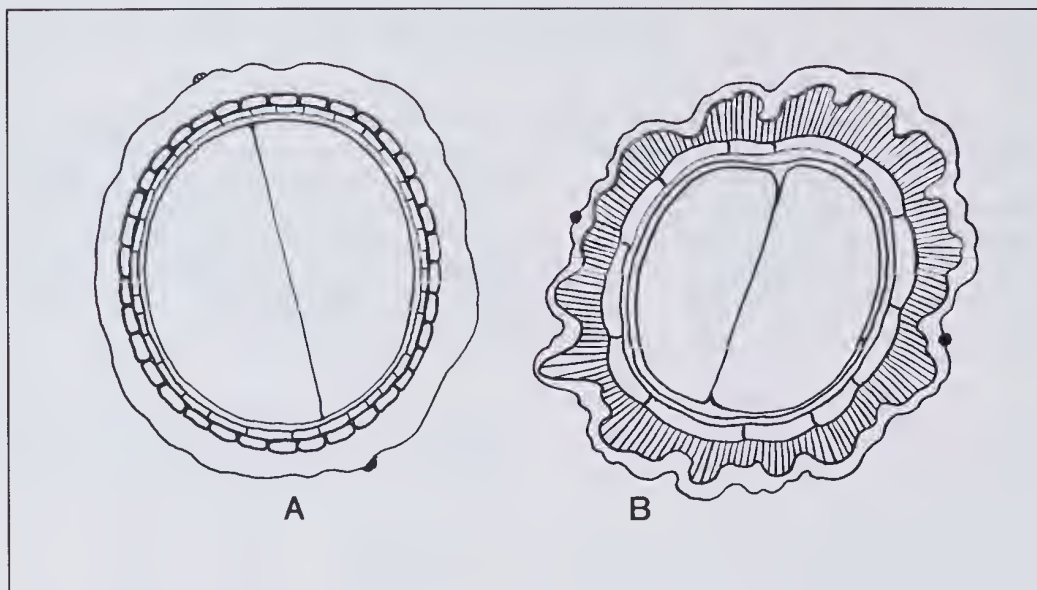


Figure 2. Transverse sections of achenes of A - *Anemocarpa calcicola* and B - *Argentipallium obtusifolium*, both semi-diagrammatic. A from H. Demarz 9760 and B from D. Hunt 3041.

Typus: Argentipallium obtusifolium (Sonder) Paul G. Wilson

Perennial herbs. Ectomycorrhiza formed. Plant covered with a dense silvery silky indumentum. Leaves alternate, simple, entire, sessile, linear to elliptic. Capitula solitary and terminal to stems or branches or in loose terminal panicles, homogamous or heterogamous, disciform. Involucre hemispherical to broad-turbinate. Involucral bracts papery, narrow-elliptic; outer bracts pale brown without lamina; inner bracts with proximal portion flat and grading into the white lamina; stereome flat, fenestrate, grading into the surrounding bract tissue, the vascular tissue not passing into the lamina; innermost bracts similar to the inner bracts. Receptacle convex, epaleate, glabrous. Female florets few or absent, with filiform corollas and few or no pappus bristles; achene as in disc florets. Disc florets perfect. Corolla narrow-cylindrical or upper portion turbinate, regularly 5-lobed; vascular strands not passing into lobes. Anther apiculum oblong to elliptic, thin; constituent cells narrow-oblong, not thickened, the marginal ones differentiated or not. Anther tails slender, shortly branched, weak or firm, equal to or exceeding collar. Anther collar narrow-oblong. Style apex truncate or rounded, shortly papillate; vascular strand either slender and ending well below apex or thick and extending to near tip. Achene terete; surface smooth; indumentum sparse or dense, of short (0.05-0.15 mm long) obovoid duplex hairs; pericarp diaphanous; testa membranous, pale brown, adnate to pericarp, cells broad-oblong, vascular strand in lateral position (in relation to cotyledons) and extending to apex of seed; carpodium several cells high. Pappus bristles free or fused towards base in small clusters, very shortly united in a ring at base, \pm persistent, slender, smooth towards base, barbellate upwards, the terminal barbellae usually clavate.

This genus is similar in floral characters to *Ozothamnus*. The latter genus differs principally in habit (its species being either shrubs or subshrubs), in the size and arrangement of the capitula, and in not being ectomycorrhizal. The achenes of *Ozothamnus* have short narrow duplex hairs whereas in *Argentipallium* they are very short and clavate to obovoid. In *Ozothamnus* there is considerable

variation in the form and length of the anther tails, whereas in *Argentipallium* the anther tails are long, stout (weak in *A. niveum*), and shortly branched.

Etymology. The name is derived from the Latin words *argenteus*, silvery and *pallium*, a mantle, in allusion to the silvery indumentum that characteristically covers the leaves and branches of species of this genus.

Key to species

1. Stem leaves small, linear, clustered in axillary fascicles *A. niveum*
1. Stem leaves solitary
 2. Tufted herb; flower head solitary on scape-like stems *A. dealbatum*
 2. Open perennial or small shrub; flower heads clustered or solitary
 3. Flower heads to 15 mm diameter, frequently corymbose; indumentum woolly.
 4. Leaves thick-woolly all over *A. blandowskianum*
 4. Leaves closely woolly below, glabrescent above *A. spiceri*
 3. Flower heads 10-25 mm diameter, solitary; indumentum a compact silky sheen
 5. Leaves narrow-oblong to linear, 5-20(60) mm long; branches never spinescent; flower heads 15-25 mm diameter, not subtended by leaves; achenes sparsely papillose *A. obtusifolium*
 5. Leaves linear or scale-like, to 8 mm long; branches sometimes spinescent; flower heads to 15 mm diameter, subtended by reduced foliage leaves; achenes densely papillose *A. tephrodes*

Argentipallium blandowskianum (Steetz ex Sonder) Paul G. Wilson, comb. nov.

Helichrysum blandowskianum Steetz ex Sonder, *Linnaea* 25:512 (1853). *Type*: 'Encounter Bay' *n.v.*

Helichrysum blandowskianum var. *dichroon* Sonder, *Linnaea* 25:512 (1852). *Type*: 'Nov.-Holl. austro-occidentalis' *n.v.*

Distribution. Found in south eastern South Australia and western Victoria.

I have not been able to find the types of the above two names but the original descriptions are clear and there is little doubt about their application.

This species differs from the other species of the genus in having a semi-terete stipe to the intermediate involucre bracts, in having a longer and more slender corolla with large ellipsoid glands on the lobes, and in the achene having a translucent pericarp with thickened radial walls and a thin weak testa. It has some similarities to the *Helichrysum elatum* group but differs profoundly in that the bract-stipe does not bear the glandular hairs that are found in *H. elatum*, and the achenial nerves are medially (not laterally) placed. In addition it is ectomycorrhizal whereas species of the *H. elatum* group are not (Warcup 1990).

Argentipallium dealbatum (Labill.) Paul G. Wilson, comb. nov.

Helichrysum dealbatum Labill., Nov. Holl. Pl. Sp. 2:45 t. 190 (1806). - *Gnaphalium niveum* Poir., Encycl. Meth. Bot. Suppl. 2:808(1812) *nom. illeg. non* L. (1753) - *G. dealbatum* (Labill.) Schultz-Bip., Bot. Zeitung 3:171(1875) *nom. illeg. non* Thunb. (1800). Type citation: 'Habitat in capite Van-Diemen'. Type *n.v.*

Distribution. Southern Victoria and Tasmania.

Argentipallium niveum (Steetz) Paul G. Wilson, comb. nov. (Figure 3)

Helipterum niveum Steetz in Lehm., Pl. Preiss. 1:475(1845). Type: In Nova Hollandia (Swan River Colonia) in solo sublimoso inferioris sinus regis Georgii III, Oct. 1840, *L. Preiss* 11 (holo: MEL).

[*Helichrysum obtusifolium* auct. non Sonder: Benth., Fl. Austral. 3:619(1867) *p.p.*; Grieve & Blackall, How to know Western Australian Wildflowers 840(1975).]

Distribution. South-west region of Western Australia.

Chromosome number: $n = 12$ *vide* Turner (1970) as *Helipterum obtusifolium*.

Argentipallium obtusifolium (Sonder) Paul G. Wilson, comb. nov.

Helichrysum obtusifolium Sonder, Linnaea 25:513(1853). Type: Encounter Bay, South Australia, November, *F. Mueller* (holo: MEL 604819).

Distribution. Southern South Australia, western and southern Victoria, south coast of New South Wales, and northern Tasmania.

Note. There is considerable difference in the habit and capitulum shape and size in different geographical variants of this species. In Kangaroo Island, South Australia, the plants are small, 6-12 cm high, the involucre short (3-4 mm high) and urceolate, the laminae to the involucre bracts 3-4 mm long, and the pappus bristles white with clavate cilia at the apex. This variant resembles the Western Australian species, *A. tephrodes*, which differs most obviously in having smaller leaves and densely papillose achenes. A rather similar plant is also found on the Fleurieu Peninsula. In south-eastern South Australia, Victoria, and in New South Wales the plants are larger with longer leaves, larger and hemispherical involucres, laminae to 10 mm long, and the pappus bristles with translucent acute terminal cilia. However, since the variants appear to grade into each other I have not attempted to provide an infra-specific classification.

Argentipallium spiceri (F. Muell.) Paul G. Wilson, comb. nov.

Helichrysum spiceri F. Muell., Fragm. 11:47(1878). Type: Near Longley, Tasmania, *A. Simson* (holo: MEL).

[*Helichrysum obtusifolium* auct. non F. Muell.: Rodway, Tasmanian Flora 87(1903) *p.p.*]

Distribution. Southern Tasmania.

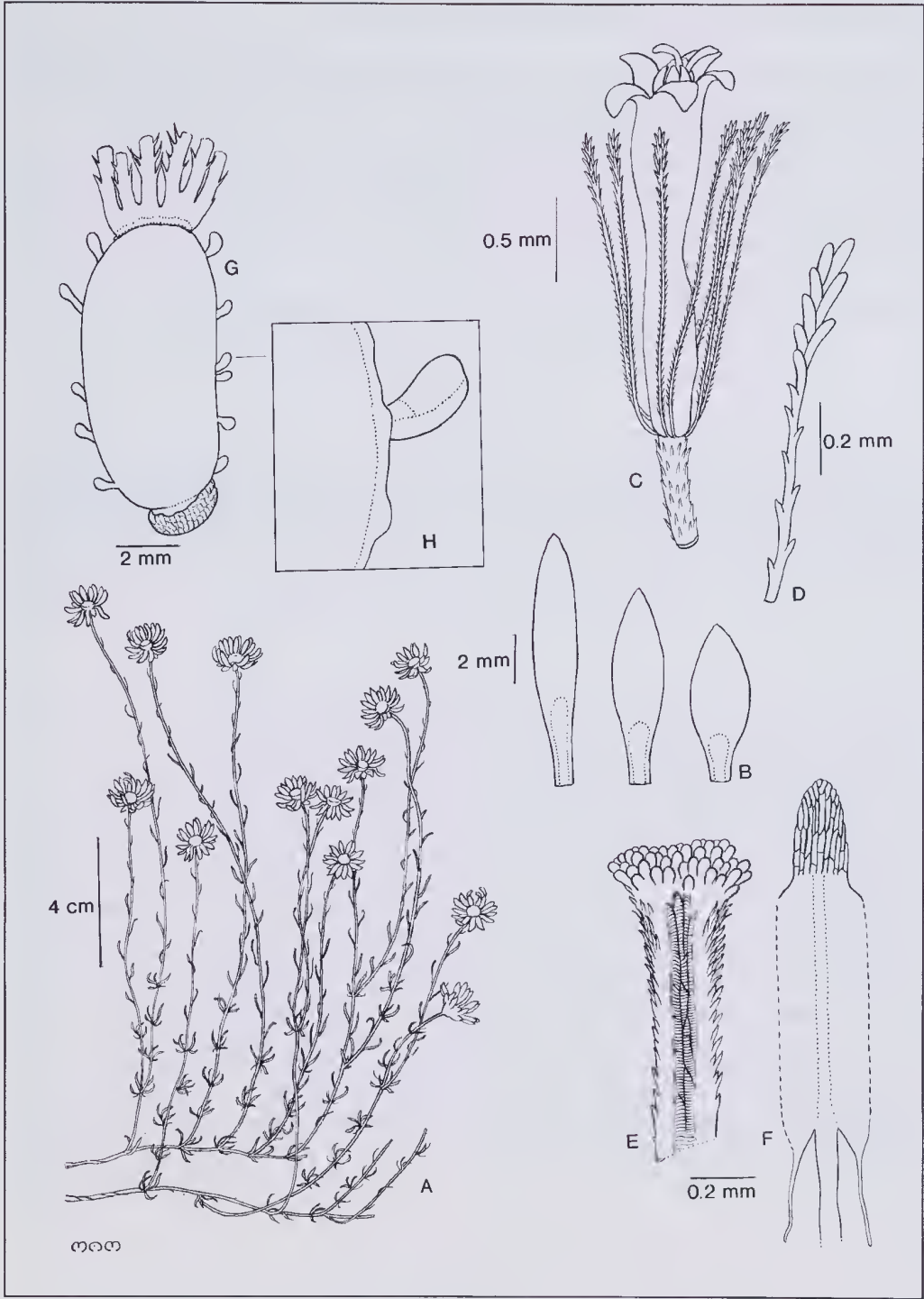


Figure 3. *Argentipallium niveum*. A - habit; B - inner, intermediate and outer involucre bracts; C - floret; D - apex of pappus bristle; E - style apex; F - anther; G - achene; H - duplex hair on pericarp. From P.G. Wilson 7871.

Argentipallium tephrodes (Turcz.) Paul G. Wilson, comb. nov.

Ozothamnus tephrodes Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2):79(1851). - *Helichrysum obtusifolium* var. *tephrodes* (Turcz.) Benth., Fl. Austral. 3:619(1867). Type: J. Drummond 5th coll. no. 385 (holo: KW, photo seen; iso: MEL, PERTH).

Helichrysum obtusifolium var. *squamiger* Benth., Fl. Austral. 3:619(1867). Type citation: 'Near Oldfield river, Maxwell'. Syntypes: In tea tree salt flats near Oldfield R., G. Maxwell (MEL); Melaleuca flats, near Oldfield R., G. Maxwell (MEL).

Distribution. Southern Western Australia from Fitzgerald River east to Israelite Bay.

Acknowledgements

I am grateful to Philip Short (MEL) for making available to me slides of transverse sections of achenes of various species of '*Helipterum*' and '*Helichrysum*', to Ray Cranfield and Cheryl Parker for preparing slides of sections of achenes, and to the herbaria AD, HO, and MEL for the loan of specimens.

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The classification of the genus *Waitzia* Wendl. (Asteraceae: Gnaphalieae)

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Abstract

Wilson, Paul G. The classification of the genus *Waitzia* Wendl. (Asteraceae: Gnaphalieae). Nuytsia 8(3): 461-477 (1992). The circumscription of *Waitzia* is discussed and a narrow generic concept proposed. Five species and two infraspecific taxa are recognised. A key is provided and full synonymy given. One new species combination, *W. nitida*, is made; two new varieties are described. *Waitzia citrina*, *W. conica* and *W. paniculata* are excluded from the genus.

Introduction

During an ongoing investigation into the taxonomy of the Australian species placed in *Helipterum* DC. and *Helichrysum* Miller it became evident that the genus *Waitzia* Wendl. (1808) should also be studied since some of the species included in it appeared to be closely related to species of *Helipterum* and *Helichrysum*. Further investigation indicated that as currently accepted it was polyphyletic. However, with three of the taxa transferred to other genera it consists of five closely related species. The characters that have been used to discriminate these related species in Floras and in revisional papers over the past 150 years have not permitted them to be correctly distinguished. Moreover an examination of specimens in Australian and some overseas herbaria, including specimens studied by George Bentham (1867) and Ferdinand Mueller (1896), indicated that botanists have always had confused concepts of the taxa. I have therefore investigated the taxonomy of the genus and have endeavoured to place it in the context of its related taxa.

Since the family Asteraceae will shortly be written up and published in vols 37 and 38 of the Flora of Australia I have only provided descriptions for the infraspecific taxa. Because of the absence of species descriptions I have included in the key rather more detail than is strictly necessary for the purpose of identification.

Historical

Waitzia Wendl. (1808) was the third generic name published in the *Helipterum* - *Helichrysum* complex that was based on an Australian plant, the two earlier names being *Podolepis* Labill. (1806) and *Podosperma* Labill. (1806) (*nom.rej.* = *Podotheca* Cass.), both of which are relatively distinct

from the remainder of the complex (Short 1989) and do not affect the application of Wendland's name. The delimitation of *Waitzia* is thus clearly of particular significance, since, depending on its circumscription, it could encompass a few or numerous species in the *Helipterum* - *Helichrysum* complex.

The name *Waitzia* Wendl. (1808) was based on *W. corymbosa*, a plant cultivated in the royal gardens of Herrenhausen in Germany. The origin of the plant was indicated as doubtfully 'Neu-Holland'. The plant illustrated and described is of a species found only near the west coast of Western Australia from about 160 km north of Geraldton to Shark Bay. It is probably from the Shark Bay region that the seed originated since this is the only portion of that general area that had been visited by plant collectors prior to 1808. The generic name was ignored by early 19th century botanists including de Candolle (1838) and Bentham (1837) but recognised by Steetz (1845) who correctly synonymized under it *Viraya* Gaudich. (1830) and *Morna* Lindley (1837). Bentham (1837) treated a number of species under *Leptorhynchus* Less. (1832) which were later accepted as such by de Candolle (1838) but which Steetz (1844) transferred to *Waitzia* and Bentham (1867) later accepted as belonging here.

The genus *Viraya* was described by Gaudichaud (1830) who based it on a plant collected from Shark Bay. The name was considered by de Candolle (Jan. 1838) to be a later homonym of *Vireya* Blume (1826), *Vireya* Raf. (1814), and *Virea* Adans. (1763). He also considered that the name should be spelt *Vireya* (since it honoured J.-J. Virey) and would then be a precise homonym of Blume's generic name. De Candolle therefore placed *Viraya* Gaudich. (1830) in synonymy under *Leptorhynchus* Less. (1832) even though the latter name was published two years after the former. Under *Leptorhynchus* two informal sections were recognised by de Candolle; the first 'section' he associated with the name '*Aphanorhynchus* Less. syn. 273' and placed under it those species with short achene beaks (which included the two syntype species of *Leptorhynchus*), while the second 'section' he associated with the name *Viraya* Gaudich. and placed under it species with long beaks (which included species now placed in *Waitzia*). Lessing does not appear to have published the name to which his authorship was attached and its use by de Candolle was therefore possibly the result of personal communication between the two botanists for it is known that de Candolle widely distributed draft copies of his Compositae 'Prodromus' treatment some years before its publication (Wilson 1989). Use of the name by de Candolle may also have been due to the long illness that he suffered about this time. His illness delayed publication of the Compositae treatment and was probably responsible for numerous errors in its text (Bentham 1873b). The monotypic genus *Morna* Lindley (1837) was also recognised by de Candolle (1838) but with an indication of uncertainty since he had seen no material. Later Endlicher (June 1838) formally published the name '*Leptorhynchus* a. *Aphanorhynchus*' (without indication of rank) based on *Chrysocoma squamata* Labill. (the type of *Leptorhynchus*). Endlicher also adopted de Candolle's other informal section but called it '*Leptorhynchus* b. *Morna*', not 'b. *Viraya*', since he similarly considered the name *Viraya* Gaudich. to be illegitimate (a later homonym) while he recognised *Morna* Lindley to be a synonym of it.

Meissner (1839) recognised *Morna* and *Leptorhynchus* as separate genera and clearly discriminated the two. However Reichenbach (1841) once more united them but under the name *Aphanorrhynchus* which he published as a replacement for *Leptorhynchus* Less. since the latter, he explained, was illegitimate having been used already for a genus of insects; he again recognised *Morna* as an infrageneric group. These infrageneric names were given the formal rank of *sectio* by Pfeiffer (1873).

Therefore, until 1845, botanists recognised only one genus for the taxa now placed in *Leptorhynchus* and in *Waitzia* (the recognition of *Morna* by de Candolle and Meissner being due to lack of personal knowledge of its type species). Since the generic name *Waitzia* had been overlooked, and because

Viraya Gaudich. (1830) was considered to be a later homonym, the name *Leptorhynchos* (1832) was by some botanists accepted as correct; while those who considered that plant names should not duplicate names already applied to animals the name *Aphanorrhynchus* Reichb. (1841) was accepted.

In 1845 Steetz resurrected the name *Waitzia* Wendl. (1808) and clearly distinguished the genus from *Leptorhynchos* on the lines previously adopted by Meissner. He also described the monotypic genus *Pterochaeta* which he considered to be intermediate between *Waitzia* and *Helipterum*. This name was synonymized under *Waitzia* by Bentham (1867) along with *Viraya* and *Morna*.

Changes made since Bentham (1867) have been at the species level. In 1883 Mueller misapplied the name *Waitzia podolepis* (Gaudich.) Benth. to a plant collected by 'Polak' near the Gascoyne River and provided a description. The species represented by this collection has since been described as *Waitzia conica* B. Turner (1966). Mueller posthumously (1896) published corrections to the various *Waitzia* species names used by Bentham and these amendments were later accepted by Diels and Pritzel (1905) who also discussed the ecology and distribution of the various taxa. They indicated that *W. steetziana* (i.e. *W. citrina*) was distinct from *Waitzia s.str.* and a derivative of *Helipterum* while *W. paniculata* they considered to be of a very different origin again.

I agree with Diels and Pritzel that both *Waitzia citrina* and *W. paniculata* are anomalous in this genus and, along with the subsequently described *W. conica*, I have transferred them to other genera (Wilson 1992a). *Waitzia paniculata* is transferred to the monotypic genus *Pterochaeta* as *P. paniculata* Steetz, *W. citrina* to the expanded genus *Rhodanthe* as *R. citrina* (Benth.) Paul G. Wilson, and *W. conica* to the new genus *Haptotrichion* as *H. conicum* (B. Turner) Paul G. Wilson.

Generic affinities

The genus *Waitzia* was placed in the tribe Gnaphalieae subtribe Helichryseae by Bentham (1867) and later (1873a) in the tribe Inuleae ('Inuloideae') subtribe Gnaphalieae series Helichryseae. The latter classification at tribal level has been accepted until recently. Anderberg (1989) provided a history of the various classifications and proposed a reassessment of the Inuleae *sensu lato* in which the Gnaphalieae *s.str.* is recognised as a distinct tribe. The genus *Waitzia*, Anderberg concluded, should be placed in the Gnaphalieae *s.str.* to form part of the 'Waitzia clade' along with the genera *Leptorhynchos*, *Podolepis*, *Asteridea*, and some Australian *Helipterum* and *Helichrysum* species. Anderberg later (1991) indicated that *Waitzia* should be placed in the *Waitzia* group of the subtribe Angianthinae along with *Gratwickia*, *Chrysocephalum*, *Leptorhynchos*, *Asteridea*, *Podolepis*, and *Triptilodiscus* all of which had involucre bracts with divided stereomes; he pointed out that as currently circumscribed *Waitzia* was polyphyletic and that *W. citrina* differed from the other species in having an undivided stereome and in lacking the diagnostic trichomes on the achenes.

I concur with Anderberg as to the relationship of *Waitzia sensu stricto* to these genera and accept his tribal and subtribal classification.

The position of *Waitzia* within the 'Waitzia group' requires an explanation. The genus *Waitzia* had been associated by Bentham (1867, 1873a) and by later authors with *Leptorhynchos* Less., *Helipterum* DC., *Helichrysum* Miller, *Axiolaena* Benth., and *Asteridea* Lindley (as *Athrixia*).

The two genera *Leptorhynchos* and *Asteridea* form a close knit group the species of which possess organs that share a number of similar characters. The narrow elliptic achenes (with or without a neck) have a thin translucent pericarp with 2-celled tooth-like papillae with one cell overtopping the other (Anderberg 1989), a thick soft testa free from the pericarp, and persistent barbellate pappus bristles; the corolla tubes are curved and overhang the involucre with the vascular strands passing to the apex of the corolla lobes; the apical appendages of the anther are small (c. 0.2 mm long) and are made up of unthickened cells, and the style apices are relatively small and truncate.

Waitzia, in the strict sense, consists of plants with linear leaves, an arachnoid and glandular-stipitate indumentum, capitula with scarious bracts that have terete glandular stipes (linear in the innermost two series), apical appendages of anther relatively large (ovate, c. 0.5 mm long, with narrow-oblong unthickened cells), deltoid to narrowly elliptic style apices in which the stout vascular strand extends to the tip, achenes with slender necks and 2-celled tooth-like papillae in which the lower cell overtops the upper, pericarp thin and transparent, testa thick and ruminate with oblong crystals and with oblong epidermal cells that are regularly corrugate on their margins, pappus bristles barbellate and shortly united at the base with the pappus eventually deciduous as a whole from the apex of the achene neck.

The genera *Helipterum* and *Helichrysum* (in Australia) are a polyphyletic assemblage of species (Anderberg 1989, Wilson 1989) and it is to some members of these genera, in particular to the *Helipterum albicans* group of species, that *Waitzia* is clearly allied. The *Helipterum albicans* group, which is referred to the genus *Leucochrysum* (DC.) Paul G. Wilson (Wilson 1992b), consists of *Helipterum albicans* (A.Cunn.) DC., *H. fitzgibbonii* F. Muell., *H. albicans* var. *graminifolium* Paul G. Wilson, *H. molle* (DC.) Paul G. Wilson, and *H. stipitatum* (F.Muell.) Benth. These five species resemble *Waitzia* in indumentum, leaf-shape, and in the morphology of the involucral bracts, corolla, anthers, and style apices. The species differ from *Waitzia s.str.* in habit, in having plumose pappus bristles that are shed by breaking shortly above the base, in the lack of an achene neck, and in the absence of 2-celled tooth-like achene papillae.

Morphological characters

The characters used in the past to distinguish the species of *Waitzia* sect. *Waitzia* have been based largely on the colour and shape of the involucral bracts. This has led to some confusion since two of the species have both white and yellow variants and a range of bract shapes. It has therefore been necessary to incorporate other characters into the discrimination of the species. These additional characters are found in the indumentum, capitulum shape, and in the arrangement, relative size, and surface texture of the bracts.

Indumentum. All species have some septate-flagellate hairs (Ramayya 1962) on leaves and stem. The flattened oblong cells of the biseriate to uniseriate proximal portion of the hairs vary in number with species and with their position on the plant while the uniseriate filiform distal portion varies considerably in length. Depending on the density of the hairs and the lengths of the proximal and distal portions the indumentum can be rough or smooth and thinly to densely arachnoid.

Most of the species also have biseriate or uniseriate capitate glandular hairs on the leaves and stem, or these may be restricted to the branches of the inflorescence. In *Waitzia acuminata* and *W. nitida*

they are absent (except on the stipes of the involucre bracts). Both types of hairs are sometimes shed above the base to leave a short hard projection that produces a rough surface to the leaf. The glandular hairs on the stipes of the bracts have a single globular cell at the apex.

Sessile globular glandular hairs are present on the leaves and branches of some species in addition to the longer hairs.

Leaf shape. In all species the leaves are sessile, linear to very narrowly oblong (or the basal leaves very narrow-obovate) and usually with the margin recurved, at least on drying. The upper leaves may be slightly decurrent and sometimes semiamplexicaul. Variation within a species is considerable and probably largely environmentally induced since plants in cultivation have, in general, broader and flatter leaves than their wild counterparts.

Involucre. This can be hemispherical, cup-shaped or, in *W. acuminata*, turbinate at the base with the involucre bracts descending along the peduncle.

Involucre bracts (see Figure 1). The bracts, except for the innermost two series, have stipe-like claws that are shortly glandular pilose and arachnoid; the lamina varies from ovate-cordate to narrowly triangular, obtuse to acute or acuminate, entire to fimbriate-serrate. The two innermost series of bracts have linear claws with a shortly glandular pilose sterome and a narrow scarious margin; the lamina is very small, scarious, and white or coloured.

The surface of the laminae may be smooth or minutely roughened due to the emergent distal ends of some of the epidermal cells. In *W. corymbosa* the two innermost series of involucre bracts lengthen during anthesis to well exceed the intermediate and outer bracts. The outer and intermediate involucre bracts may remain erect, or become reflexed or spreading during anthesis.

Pappus (see Figure 2). The pappus bristles are barbellate (or pilose at the base) and eventually deciduous as a whole from the achene neck. They are generally colourless, white, or faintly tinged with yellow near the base, except in *W. nitida* in which the distal half of the pappus is always pale yellow.

Mycorrhizal relationship. *Waitzia* species form ectomycorrhiza as do species in *Leucochrysum* and in *Leptorhynchos* (Warcup 1990). In this they differ from species in the *Rhodanthe* complex.

Achene venation. The species of *Waitzia* have a very short vascular strand in the testa which contrasts with the situation in *Leucochrysum* in which the strand passes to the apex of the seed. The vascular strands of the testa and pericarp are arranged in a lateral position in relation to the cotyledons which is the same position as is found in *Leucochrysum*.

Chromosome numbers. Turner (1970) has recorded a count of $n = 10$ for *W. nitida* and of $n = 12$ for *W. suaveolens*. No count has been published for the species now placed in *Leucochrysum*.

Hybridization

Hybridization between species appears to be rare in *Waitzia* and only two possible cases have been observed.

A collection from Kojonup (*Meebold* 7323, PERTH) consists of specimens that appear to have been gathered from a hybrid swarm involving *W. acuminata* subsp. *acuminata* and *W. suaveolens* var. *suaveolens*.

Some specimens gathered between Kalbarri and Geraldton appear to be intermediate between *W. suaveolens* var. *suaveolens* and *W. acuminata* subsp. *albicans*. They have bracts that are only very faintly scabridulous and are somewhat intermediate in shape between those of the putative parents, while some of the specimens lack the stipitate glands that are present in *W. suaveolens* but absent in *W. acuminata*. Examples are: *R.C. Wemm* 1111B, *D. & N. McFarland* 1203, *M.G. Corrick* 8122, and *A.J. Cough* 269, all PERTH.

Both of the putative parents are found near the area where these specimens were collected.

Waitzia Wendl.

Wendl., Coll. Pl. 2:13 t.42(1808). *T: Waitzia corymbosa* Wendl.

Viraya Gaudich. in Freyc., Voy. Uranie 466 t.89(1830); Post *et* Kuntze, Lexicon Gen. Phan. 590(1903) '*Vireya*' pro syn. sub *Waitzia*. - *Leptorrhynchus* sect. *Viraya* (Gaudich.) DC. ex Pfeiffer, Nom. Bot. 2:86(1874). *T: Viraya podolepis* Gaudich.

Morna Lindley, Bot. Reg. t.1941(1837). - *Aphanorrhynchus* 2. *Morna* (Lindley) Reich., Deut. Bot. Herb.-Buch. 1:90(1841) nom.illeg. - *Aphanorrhynchus* sect. *Morna* (Lindley) Reich. ex Pfeiffer, Nom. Bot. 1:229(1873) nom.illeg. - *Leptorrhynchus* b. *Morna* (Lindley) Endl., Gen. Pl. 445(1838). - *Leptorrhynchus* sect. *Morna* (Lindley) Endl. ex Pfeiffer, Nom. Bot. 1:229(1873). *T: Morna nitida* Lindley.

Note: The generic name *Aphanorrhynchus* (Endl.) Reich. (1841) is ultimately based on *Leptorrhynchus* Less. (1832). The latter name was considered by Reichenbach to be illegitimate since there existed an insect genus *Leptorrhynchus*.

Annual erect herbs, sparsely to moderately cobwebby with septate flagellate hairs with or without stalked glandular hairs (that may leave a hard base when shed to form a scabrid surface). Leaves alternate, linear to narrow-oblong, sessile, margin mostly recurved on drying. Inflorescence terminal, cymose, the uppermost leaves grading into linear capitula-subtending bracts (or these with scarious narrow-elliptic laminae) that grade into the outer involucre bracts. Involucre \pm hemispherical to turbinate. Outer and intermediate bracts multiseriate, stipitate; stipe terete with divided stereome, with stalked glandular hairs and \pm cobwebby; lamina scarious, ovate or narrow-triangular, entire to serrate, smooth or minutely scabridulous from the emergent distal apices of the epidermal cells, white to violet, yellow or gold, erect or at length spreading or reflexed on the stipe. Innermost bracts erect, shorter than or exceeding intermediate bracts; stipe linear with narrow scarious margin and prominent

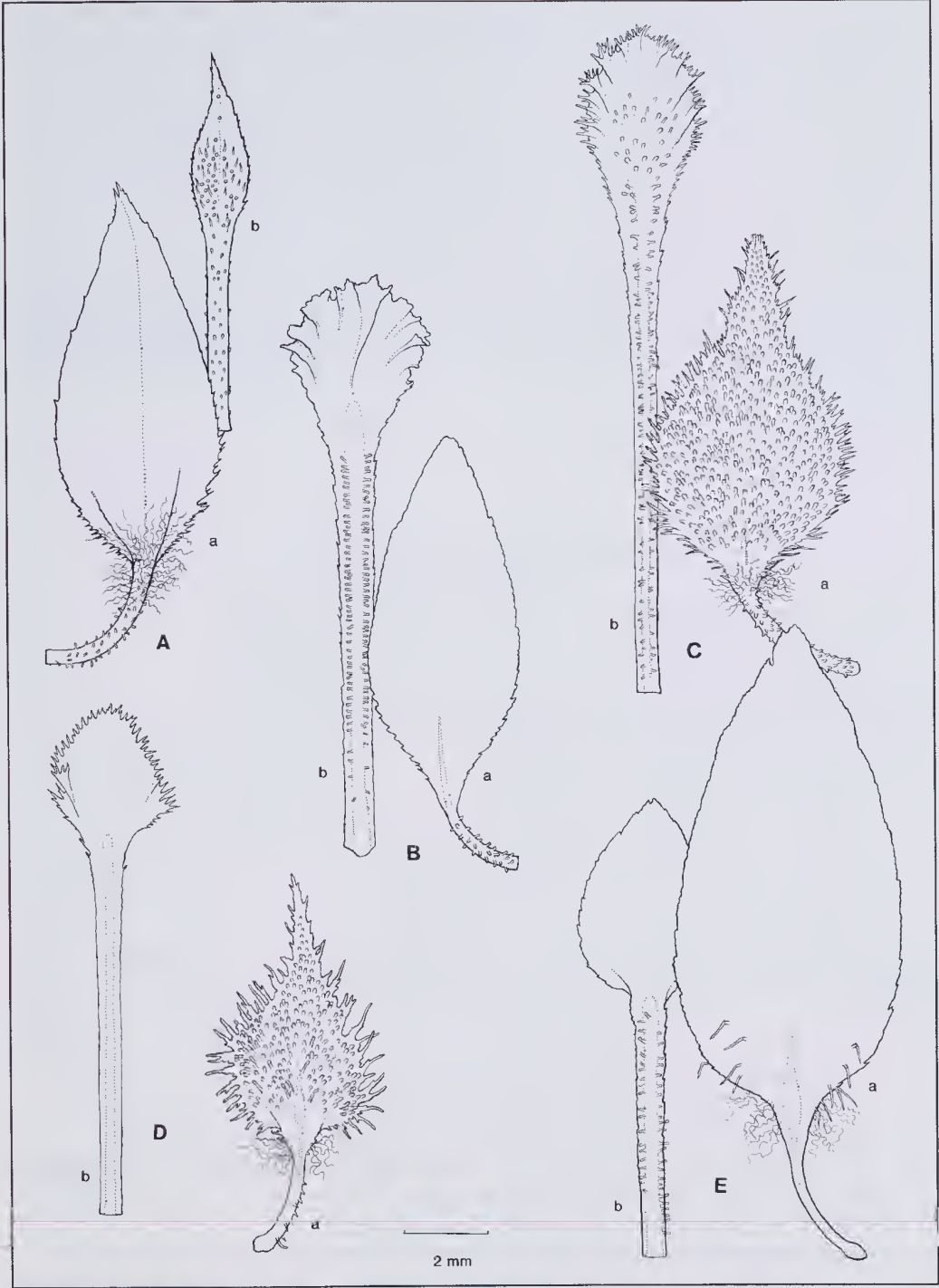


Figure 1. Intermediate and inner involucral bracts of *Waitzia* species. A - *W. nitida*. B - *W. podolepis*. C - *W. corymbosa*. D - *W. acuminata* var. *acuminata*. E - *W. suaveolens* subsp. *suaveolens*. (a - intermediate bract; b - inner bract.)
A from R. Saffrey 147. B from W. Blackall 563. C from P. Wilson 12198. D from P. Wilson 12036. E from J. Koch 465.

midrib with stalked glandular hairs; lamina very short otherwise either similar to the intermediate bract-laminae or hyaline and minute. Receptacle rounded, glabrous. Florets numerous, bisexual, actinomorphic. Corolla tube narrow-cylindrical, turbinate above, prominently 5-lobed, glabrous except for short glandular hairs on outside of lobes, smooth within; cells of inner epidermis of throat regularly and prominently undulate; vascular strands extending to base of lobes. Anthers: appendage narrow-ovate, c. 0.5 mm long; cells narrow-oblong, thin-walled; tails slender, firm, \pm equal to collar. Style apex deltoid to narrow elliptic; vascular strand stout and extending to tip. Achene compressed ellipsoid with slender neck, almost smooth or barbellate with myxogenic 2-celled papillae; neck glabrous, barbellate or shortly pilose. Pericarp thin, translucent, collenchymatous, of narrow-oblong cells, in most species myxogenic; vascular strands laterally oriented with reference to cotyledons. Testa free from pericarp, weakly coriaceous, brown, with scattered crystals; apex laterally flattened and sterile; outer epidermis of narrow-oblong cells prominently and regularly undulate on margin; vascular strand confined to base or to near base of seed, laterally orientated. Pappus bristles numerous, shortly united at base, dentate, sometimes pilose at base, eventually deciduous as a whole from achene neck.

Five species endemic to Australia.

Key to species and infraspecific taxa

- 1. Inner involucre bracts yellow, outer yellow, orange or straw-coloured
 - 2. Pappus yellow in upper half; upper leaves and branches cobwebby, not glandular; bracts yellow 3. *W. nitida*
 - 2. Pappus white or colourless in upper half; upper leaves and branches cobwebby or shortly glandular pilose; intermediate bracts yellow, outer bracts yellow or orange
 - 3. Upper leaves and branches cobwebby, bracts minutely scabridulous and descending down peduncle (Figure 1A), capitula not subtended by linear herbaceous bracts 1. *W. acuminata* var. *acuminata*
 - 3. Upper leaves and branches shortly glandular pilose; bracts smooth; capitula subtended by linear herbaceous bracts 5. *W. suaveolens* var. *flava*
- 1. Inner involucre bracts white, outer bracts white, pink, orange, or brown
 - 4. Innermost bracts with pale brown mottled laminae
 - 5. Innermost bracts long exceeding the pink and white intermediate bracts; lamina of innermost variably crinkled, prominently ciliolate (Figure 1C); outer and intermediate bract-laminae soon reflexed on stipes, long acuminate 2. *W. corymbosa*
 - 5. Innermost bracts \pm equal to the intermediate bracts, lamina crinkled, minutely dentate, not ciliolate (Figure 1B); outer and intermediate bract-lamina white or straw coloured, not or tardily spreading, acute to obtuse 4. *W. podolepis*
 - 4. Innermost bracts with white or hyaline laminae

6. Capitula not obviously subtended by linear herbaceous bracts. Involucral bracts acuminate, slightly rough (Figure 1D); upper branches and leaves somewhat cobwebby not shortly glandular pilose 1. *W. acuminata* var. *albicans*
6. Capitula subtended by linear herbaceous bracts. Involucral bracts acuminate to acute or obtuse (Figure 1B); upper branches and leaves shortly glandular pilose with or without cobwebby hairs 5. *W. suaveolens* var. *suaveolens*

1. *Waitzia acuminata* Steetz in Lehm., Pl. Preiss. 1:453(1845). (Figure 2). Type citation: 'In Australasia orientali-occidentali leg. c. Preiss. Herb. Preiss. sine No. Roe! Drummond! (V.s. in herb. aulico Vindobonnense!)'. *Lectotype* (here chosen): *Roe s.n.* (W); *syntypes*: *Preiss s.n.* (LD, MEL 221975), *Drummond* 286 (W).

[*Waitzia corymbosa* auct. non Wendl.: Benth., Fl. Austral. 3:635(1867); Chittenden, Dict. Gardening edn 2, 4:2258(1977)]

var. *acuminata* (Figures 1D, 2)

Waitzia discolor Turcz., Bull. Soc. Imp. Naturalistes Moscou 24/1:194(1851). *T.*: *J.Drummond* 4th coll. n. 198 (holo: KW photo scen; iso: MEL 1585193).

Involucral bracts orange-yellow.

Distribution. Western Australia south of the 23° latitude, southern Northern Territory, South Australia, north western Victoria, western New South Wales, and extreme southern central and western Queensland.

var. *albicans* Paul G. Wilson, subsp. nov.

Bractae involucri albae vel bracteis exterioribus violaceo-rubrae.

Typus: Western Australia, 21 km from Northampton towards Port Gregory, 'buds deep pink, becoming more pale as head opens and eventually white, disc florets yellow, numerous plants amongst low scrub on rocky outcrop', 6 Oct. 1972, *S.Paust* 1258 (holo: PERTH; iso: AD, CANB, K, MEL, NSW, S).

Involucral bracts white or the outer violet-red.

Distribution. Western Australia, near the west coast between York and Hamelin Pool (c. 31° 30'S to 26° 30'S).

The distribution of the two varieties overlaps between Hamelin Pool and Geraldton but I have seen no evidence to suggest that in this area they grow together in the same locality. However, collections made by J.H.Gregory at Northam in 1901 and by Keighery & Alford c. 17 km west of York in 1985 (both PERTH) are of a mixture of both varieties. These two localities are at the southernmost

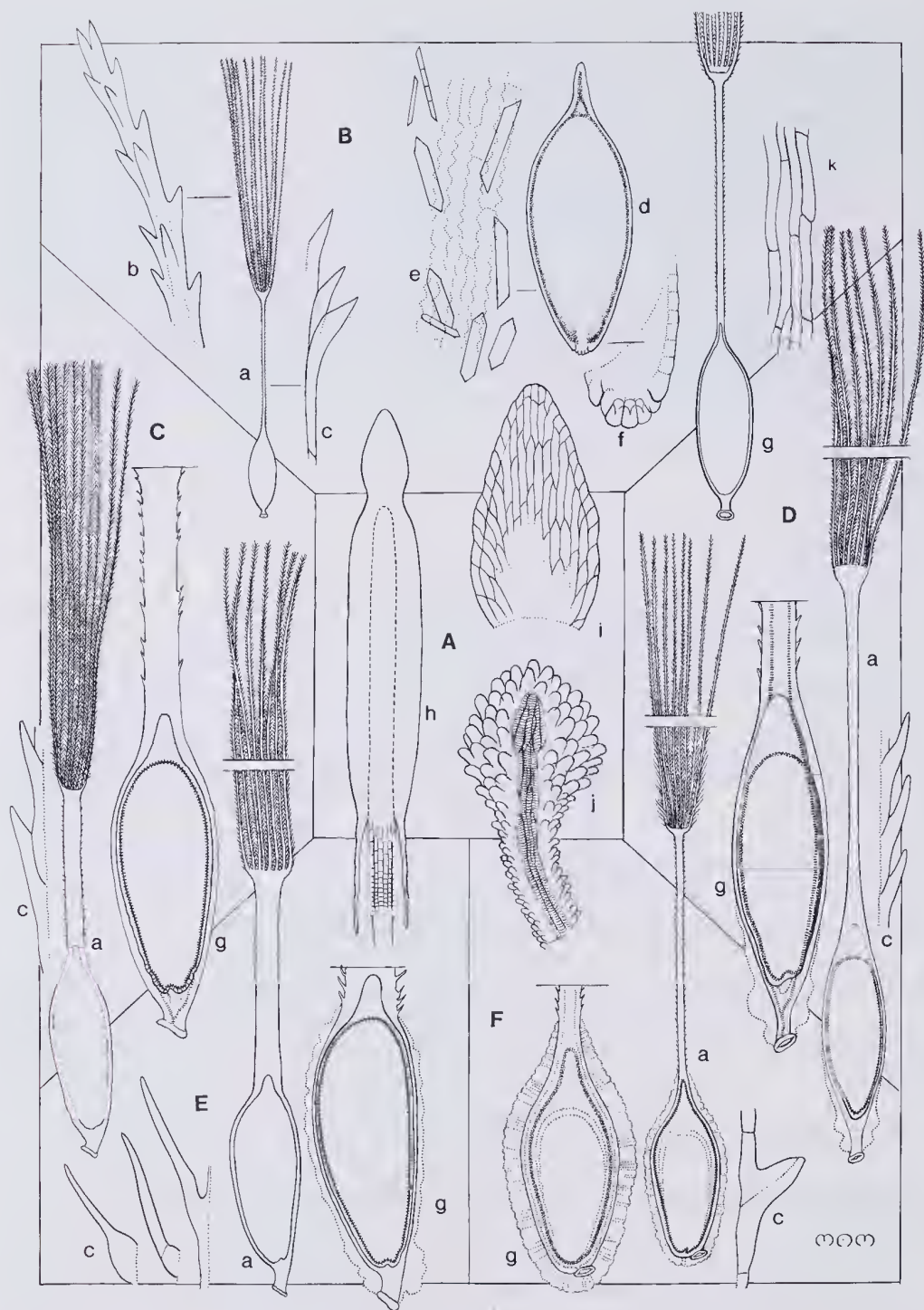


Figure 2. A & C - *Waitzia suaveolens*. B - *W. acuminata*. D - *W. corymbosa*. E - *W. podolepis*. F - *W. nitida*. (a - achene with pappus; b - apex of pappus bristle; c - barbellate hairs of achene neck; d - seed removed from pericarp; e - surface view of testa showing undulate cells and calcium oxalate crystals; f - basal portion of testa; g - achene; h - anther; i - anther appendage; j - style apex; k - surface view of cells of pericarp.)

A & C from R. Royce 4731. B from A.S. George 8437. D from P. Wilson 12198. E from H. Demarz 8996. F from R. Saffrey 147.

distribution of var. *albicans* and the westernmost distribution (at that latitude) of var. *acuminata*. Where the two varieties grow together they differ only in the colour of the involucral bracts.

2. *Waitzia corymbosa* Wendl., Coll. Pl. 2:13, t.42(1808). - *W. corymbosa* f. *wendlandiana* Steetz, Pl. Preiss. 1:451(1845) excluding specimen cited, *nom. illeg.* - *W. corymbosa* var. *wendlandiana* (Steetz) Diels & Pritz., Bot. Jahrb. 35:626(1905) *nom. illeg.* Type citation: 'Das Vaterland: Neu-Holland?' *Lectotype* (here chosen): Wendland *op.cit.* t. 42. (Figures 1C, 2D)

Distribution. Shark Bay south to Kalbarri.

The name *Waitzia corymbosa* has been incorrectly used by previous authors. The species was unknown to Bentham (1867) who misapplied the name to plants of *W. acuminata*, and unknown to Mueller (1896) who misapplied the name principally to collections of *Waitzia suaveolens* var. *suaveolens*. Diels and Pritzel (1905) considered it to be conspecific with *W. nivea* (i.e. to *W. suaveolens*). The name was omitted by Grieve and Blackall (1975) who included the species under the misapplied name *W. podolepis*.

The specimen on which Wendland based his description could not be found in the Wendland herbarium (herb. GOET), *fide* G. Wagenitz, pers. comm. I have therefore designated the illustration that accompanied the description as the lectotype.

3. *Waitzia nitida* (Lindley) Paul G. Wilson, comb. nov. (Figures 1A, 2F)

Morna nitida Lindley, Bot. Reg. t.1941(1 March 1837). Type citation: 'inhabiting the dry country about the Swan River, whence it was introduced in the year 1835, by Sir James Stirling. The first time it was publicly seen in this country was at one of the great exhibitions held in the Garden of the Horticultural Society in 1836, when the judges awarded to Robert Mangles, Esq. who exhibited it, a Knightian Medal.' *Lectotype* (here chosen): Right-hand specimen on sheet labelled 'TYPE. *Morna nitida* Lindl.' (CGE, photo seen). See note below.

Leptorhynchos aureus Benth. in Endl., *et al.*, Enum. Pl. Hügel 64 (April 1837). - *Waitzia aurea* (Benth.) Steetz in Lehm., Pl. Preiss. 1:452(1845). Type citation: 'King Georges Sound et Swan-River. (Hügel).' *Lectotype* (here chosen): 'Freemantle', Hügel (W, isolectotype: K); *syntype*: 'King George's Sound', Hügel (W).

? *Waitzia grandiflora* W. Thompson in T. Moore, Florist & Pomologist 4:41 & tab. (March 1865); Naudin, Revue Hort. (Paris) 185(1865); Chittenden, Dict. Gardening edn 2, 4:2258(1977). Typification: 'I received this fine species from Dr. F. Mueller, of Melbourne'.

Note: Lindley initially (1 March 1837) stated that *Morna nitida* was introduced in 1835 by James Stirling, the governor of Swan River Colony. He subsequently (Bot. Reg. 23: sub tab. 1944, 1 April 1837) corrected this statement by adding a note written by Donald Mackay, the gardener of Robert Mangles. In this note Mackay indicated that seeds of *Morna nitida* were received by Robert Mangles early 1836 and sown on 2 February 1836. A sheet in CGE has a label stating that it is the type of *Morna nitida*; the sheet bears two specimens the smaller of which has 'R. Mangles Esq.' written beside it while the other has a printed label attached which reads 'Swan River/ Capt. James Mangles, R.N.'. James was the brother of Robert Mangles in whose garden the plant was first grown. I have designated as lectotype the right-hand specimen with the James Mangles label but it is likely that the specimens had a common origin.

Waitzia grandiflora was described as having a capitulum much larger than that of *W. aurea* (i.e. of *W. nitida*) and to be almost glabrous. It is probably a variant of *W. nitida*. No material under the name *W. grandiflora* has been located in Australian herbaria nor in K or BM (*vide* G. Leach pers. comm.). Although the name is still used in horticulture in Europe (see above) I have been unable to discover to what species it is being applied.

Chromosome number: $n=10$ *vide* Turner (1970).

Distribution. Western Australia: Shark Bay (? Broome) south to Albany and Ravensthorpe and east to Merredin (? Kalgoorlie). Two collections are labelled as having come from localities that are outside the distribution range as otherwise recorded for this species; they are as follows: *E. Kelso*, 1900, Broad Arrow, north of Kalgoorlie (PERTH); Roebuck Bay (near Broome), pre 1867, *Dr Marten* (MEL 1585029).

Waitzia nitida shows very little variation throughout its range and does not intergrade with any other species.

The concept of *W. nitida* (as *W. aurea*) held by previous authors including Steetz (1845), Benth (1867), Mueller (1896), Diels & Pritzel (1905), and Grieve & Blackall (1975) also included specimens of *W. suaveolens* var. *flava* which may be most readily distinguished by its colourless pappus.

4. *Waitzia podolepis* (Gaudich.) Benth., Fl. Austral. 3:637(1867). - *Viraya podolepis* Gaudich. in Freyc., Voy. Uranie 466 t.89(1830). - *Leptorhynchos podolepis* (Gaudich.) DC., Prod. 6:160(1838). *Lectotype* (here chosen): Collected by *Gaudichaud* at Shark Bay (P'Baie de Ch. Marin, C. Gaudichaud'). (Figures 1B, 2E)

[*W. corymbosa* auct. non Wendl.: F. Mueller, Z. Allg. österr. Apotheker-Vereines 34(36):935(1896) *p.p.*]

Distribution. Western Australia: Irwin River north to Shark Bay.

An accurate description of this species was provided by Diels and Pritzel (1905) based on an original collection in herb. B which evidently came from Kunth's herbarium. They pointed out that Mueller (1896) had misapplied the name *Waitzia podolepis* to a J. Pollack collection of an undescribed species that was new to them. This unknown species was described by Turner (1966) under the name *Waitzia conica*. The microfiche photograph of the possible type specimen seen by de Candolle (G-DC) and cited by him in the *Prodromus l.c.*, is not sufficiently clear to confirm its identity, however, the description provided by de Candolle is accurate.

5. *Waitzia suaveolens* (Benth.) Druce, Bot. Exch. Club Soc. Brit. Isles 4:652(1917). - *Leptorhynchos suaveolens* Benth. in Endl. *et al.*, Enum. Pl. Hügel 64(1837). - Type citation: 'Swan-River (Hügel.)' *non vidi*.

No type material of this name has been located in the herbaria W, BM, and K. The application of the name is based on the description and on contemporary collections made around Perth in the areas visited by Hügel.

var. **suaveolens** (Figures 1E, 2A , 2C)

Morna nivea Lindley, Bot. Reg. 24:t.9(Feb.1838). - *Waitzia nivea* (Lindley) Benth., Fl. Austral. 3:636(1867). Type citation: 'raised from Swan River seeds in the garden of Robert Mangles, Esq., of Sunning Hill.' (holo: CGE 'Hort. Mangles July 1837' photo seen).

Waitzia corymbosa f. *benthamiana* Steetz in Lehm., Pl. Preiss. 1:451(1845). Based on *Leptorhynchos suaveolens* Benth., *Morna nivea* Lindley, L. Preiss 12, Hügel s.n., and F. Bauer s.n. Lectotype (here chosen): *Leptorhynchos suaveolens* Benth..

? *Helichrysum rigidulum* DC., Prod. 6: 193(1838). T: Nova Hollandia, Cult. 1832, *Sweet* (holo: G-DC photo seen).

Waitzia odontolepis Turcz., Bull. Soc. Imp. Naturalistes Moscou 24/1:77(1851); Chittenden, Dict. Gardening edn 2, 4:2258(1977). T: Western Australia, J. Drummond 5th coll. no. 382 (holo: KW photo seen; iso: MEL).

[*Waitzia corymbosa* auct. non Wendl.: F. Muell., Z. Allg. Österr. Apotheker-Vereines 34(36):935(1896) p.p. maj.; Diels & Pritzel, Bot. Jahrb. 35:626(1905).]

[*Waitzia corymbosa* f. *wendlandiana* auct. non Steetz: Steetz in Lehm., Pl. Preiss. 1:451(1845)]

Upper branches and leaves cobwebby or glandular stipitate. Corymbs congested or loose. Outer involucre bracts acuminate to acute, white, straw coloured, or purplish pink; inner involucre bracts obtuse to acute, white. Pappus colourless.

Chromosome number: n = 12 *fide* Turner (1970), see comment below.

Distribution. South west Western Australia: Geraldton to the south coast and east to Esperance.

Note 1. The description of *Helichrysum rigidulum* by de Candolle is not sufficiently detailed, nor the microfiche photograph of the type in G-DC sufficiently clear, for me to be sure that this name is synonymous with *W. suaveolens*.

Note 2. A western entity of var. *suaveolens* has obtuse inner involucre bracts whereas an eastern entity has acute (or even acuminate) inner bracts, however, the extremes of the two (which also differ in the degree of glandular indumentum, size of capitula, and openness of inflorescence) grade into each other. The eastern more glandular entity has smaller capitula and more open inflorescences, it is in some areas virtually identical with var. *flava* except in colour of bracts.

var. **flava** Paul G. Wilson, var. nov.

[*Waitzia aurea* auct. non (Benth.) Steetz: Benth., Fl. Austral. 3:636(1867) p.p.; F. Muell, Z. Allg. Österr. Apotheker-Vereines 34(36):935(1896) p.p.; Grieve & Blackall, How to know Western Australian Wildflowers pt 4:844(1975) p.p.]

Bracteae involucri flavae, anguste triangulares acutae vel acuminatae.

Typus: Mt Ridley, Western Australia, granitic slope, 7 August 1970, *K.M. Allan* 360 (holo: PERTH; iso: CANB, K).

Upper branches and leaves glandular stipitate. Corymbs loose. Involucral bracts narrowly triangular, acute or the inner acuminate, smooth, yellow. Innermost bracts with lamina ovate to oblong, scarious or pale yellow. Pappus colourless.

Distribution. Norseman area south-east to Balladonia and west to Stirling Range.

Specimens of var. *flava* have been generally referred in herbaria and in literature to *W. aurea*. The latter species differs in having an eobwebby indumentum without glandular hairs, in having obtuse bracts (not acute to acuminate) and in having yellow pappus bristles (not colourless); in addition the capitula of *W. aurea* are larger than those of var. *flava* (but of a similar size to the capitula of the western entity of var. *suaveolens*).

As noted above, var. *flava* differs from some forms of the eastern entity of var. *suaveolens* almost solely in the colour of the bracts. The two varieties may sometimes be found growing together and it was from such a mixed population that Turner, *l.c.*, recorded the chromosome number of $n = 12$.

Excluded Names

Waitzia brachyrrhyncha F.Muell., *Linnaea* 25:407(1853) = *Leucochrysum molle* (Cunn. ex DC.) Paul G. Wilson, *Nuytsia* 8:444(1992).

Waitzia brevirostris Steetz in Lehm., *Pl. Preiss.* 1:451(1845) = *Rhodanthe citrina* (Benth.) Paul G. Wilson, *Nuytsia* 8:407(1992).

Waitzia citrina (Benth.) Steetz in Lehm., *Pl. Preiss.* 1:454(1845) = *Rhodanthe citrina* (Benth.) Paul G. Wilson, *op. cit.*

Waitzia conica Turner, *Sida* 2:428(1966) = *Haptotrichion conicum* (B. Turner) Paul G. Wilson, *Nuytsia* 8:425(1992).

Waitzia dasycarpa Turcz., *Bull. Soc. Nat. Moseou* 24:77(1851) = *Rhodanthe citrina* (Benth.) Paul G. Wilson *op. cit.*

Waitzia paniculata (Steetz) Benth., *Fl. Austral.* 3:(1867) = *Pterochaeta paniculata* Steetz (see *Nuytsia* 8:422(1992).)

Waitzia steetziana Lehm., *Pl. Preiss.* 1:454(1845) = *Rhodanthe citrina* (Benth.) Paul G. Wilson, *op. cit.*

Waitzia sulphurea Steetz in Lehm., *Pl. Preiss.* 1:453(1845) = *Rhodanthe citrina* (Benth.) Paul G. Wilson, *op. cit.*

Waitzia tenella Hook., *Bot. Mag.* t.5342(1862) = *Rhodanthe citrina* (Benth.) Paul G. Wilson, *op. cit.*

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A new species of *Acomis* from the Northern Territory and a new combination in the genus *Thiseltonia* (Asteraceae: Gnaphalieae)

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Abstract

Wilson, Paul G. A new species of *Acomis* from the Northern Territory and a new combination in the genus *Thiseltonia* (Asteraceae: Gnaphalieae). Nuytsia 8(3): 479-483 (1992). The recognition of the genera *Rutidosia*, *Acomis*, and *Thiseltonia* is discussed. A new species, *Acomis kakadu*, is described from Kakadu National Park, Northern Territory, and a new combination, *Thiseltonia gracillima*, is made for the plant previously known as *T. dyeri*.

Introduction

The name *Acomis* was published by F. Mueller in 1864 and validated along with *Acomis macra* F. Muell. by a generic-specific description, but nowhere in the protologue did Mueller indicate that a new genus was involved and, in fact, both Bentham (1873) and Mueller (1882 & 1889) attributed the publication of *Acomis* to an earlier (1860) paper by Mueller where, under a description of *Rutidosia acoma*, he indicated that he had used the manuscript name *Acomis rutidosea* for this species on herbarium sheets but that he was now placing it in *Rutidosia* section *Acomis*. However, since the sectional name was not accompanied by a sectional description it was not validly published. Possibly due to the casual manner of its publication the name *Acomis* was incorrectly attributed to Bentham (1867) by Farr *et al.* (1979) and by Anderberg (1991) while the last author incorrectly indicated its type as being *A. acoma* (F. Muell) Druce (= *Rutidosia acoma* F. Muell.). The correct choice of type is critical since the type that has been designated by Anderberg (1991) and the type designated by me have different style shapes and, as is discussed below, with a revised classification could be placed in different genera.

Mueller later (1893) included *Acomis* in *Humea* Sm. (as sect. *Acomis*) along with *Haeckeria* F. Muell. (1853) (as sect. *Haeckeria*) and *Pithocarpa* Lindley (1839) (as sect. *Pithocarpa*) but he retained *Rutidosia* as a distinct genus. Mueller also indicated that he was placing *Humea gracillima* in sect. *Acomis* although he had not at that time validly publish the species name.

De Candolle (1838) recognised that the types of *Humea* Sm. (Dec. 1804) and *Calomeria* Vent. (Oct. 1804) were conspecific and he therefore synonymized the latter name under the former. Heine (1967) accepted de Candolle's synonymy but noted that *Humea* was published shortly after *Calomeria*, he therefore made a number of new combinations in the latter genus based on those names

in *Humea* recognised by Mueller (1893) and those described later based on African material. All recent authors (e.g. Lewis & Summerhayes 1951, Grieve 1975, Anderberg 1989, 1991) have followed Bentham (1867) in regarding *Pithocarpa* as a distinct genus. Willis (1967), in discussing a number of taxa related to *Cassinia*, recognised *Calomeria* and *Haeckeria* as separate genera distinct from *Acomis* and *Rutidosia*; his generic taxonomy has been accepted in Australia. The African plants that had been placed in *Calomeria* are now considered to be epappose species of *Helichrysum* (Hilliard and Burtt 1973, Hilliard 1983).

In 1896 Mueller and Tate formally published *Humea gracillima* which Mueller (1893) had previously mentioned by name only; they suggested that it was 'closely allied to *Acomis macra*'. The former taxon was subsequently described independently by Hemsley (1905) as a new genus and species, *Thiseltonia dyeri*. It differs from the species currently included in *Acomis* in being a delicate minutely glandular-puberulous annual, in having the outer florets female with very slender 4-lobed corollas, in having (in the bisexual florets) truncate style appendages with a central subulate apex, and in having a diaphanous papillose pericarp that is united to the pale brown papery testa. In *Acomis* the species are more or less woolly, the florets are all bisexual, and the pericarp is thick, crustaceous and free from the membranous testa.

The species currently placed in *Acomis*, *Rutidosia*, and *Thiseltonia* have involucre bracts with similar clearly demarcated stereomes which completely enclose the vascular strands, they also have similar corolla shapes, and similar small anthers in which the tails are fine and difficult to discern.

Although Bentham (1867, 1873) recognised both *Acomis* and *Rutidosia* DC. (1838) he considered their separation to be artificial since it was based solely on the presence (in *Rutidosia*) or absence (in *Acomis*) of a pappus. The species of the two genera can also be divided into two groups based on their style morphology. In one group the style appendage is truncate while in the other it is narrowly triangular. In the former group are found the type species of both *Rutidosia* and *Acomis*, viz. *Rutidosia helichrysoides* DC. and *Acomis macra* F. Muell.; in the latter group are found *Rutidosia leucantha* F. Muell. and *Acomis acoma* (F. Muell.) Druce. Further work may indicate that *Acomis* and *Rutidosia* are best treated as being congeneric, or it may suggest that the generic circumscription within the complex should be based more on the morphology of the style apex and less on the presence or absence of a pappus; if the former taxonomy were decided on then the correct name for the complex would be *Rutidosia*, if the latter then a new generic name would be required for those species with acuminate style apices including the single *Acomis* species described in this paper.

Anderberg (1991) comments on the close relationship between *Acomis* and *Rutidosia* and on the marked similarity of these genera to *Leptorhynchos* and *Chrysocephalum*. I agree with the first observation but not the second since I consider that the morphology of the achenes and of the involucre bracts in the first pair of genera is so obviously distinct from the morphology of the achenes and bracts in the second pair as to provide a clear generic separation.

Acomis

Acomis kakadu Paul G. Wilson, sp. nov. (Figure 1)

Herba erecta ad 40 cm alta, gossypina. Folia linearia, 2-4(8) cm longa. Involucrum hemisphericum; bracteae multiseriatae, homomorphicae; lamina ovata, alba, 4-8 mm longa. Receptaculum conicum,

villosum. Flosculi numerosi, homogami. Corolla c. 2.5 mm longa, apicem versus late turbinata. Styli angustissime triangulares. Achenium doliiforme, c. 1.4 mm longum; pericarpum crustaceum, colliculis et papillis globosis dense ornatum, bruneum.

Typus: Kakadu National Park, 10 km west-south-west of Jabiru East, 15 May 1980, *L.A. Craven* 5466 (holo: CANB 307405; iso: CANB 307406, PERTH).

Erect annual herb to 40 cm high. Stem single, slender, grey cottony, giving off branches above the base. Leaves alternate, narrow linear, 2-4(8) cm long, 1 mm wide, very sparsely cottony. Inflorescence corymbose, peduncles 1-3 cm long, cottony, bearing a few foliaceous bracts with scarious apices that grade into the involucre bracts. Involucre hemispherical. Involucre bracts multiseriate, loosely arranged, homomorphic; claw broad-oblong, c. 2 mm long, 1 mm wide, sparsely long-ciliate, filled by a green flat stereome except for the narrow translucent margin; abruptly separated from the lamina by a horizontal fold; vascular strand branched, not extending beyond the stereome; lamina ovate, white, 4-8 mm long. Receptacle conical, c. 3 mm high, smooth, white-villous. Florets numerous, homogamous, actinomorphic, equal to involucre. Corolla narrow-cylindrical below and very sparsely pilose, broadly turbinate above, in all c. 2.5 mm long; lobes 5, triangular, c. 1 mm long, smooth within, very sparsely and minutely glandular puberulous outside, vascular strands extending to near tips. Anther loculi c. 1 mm long; appendage broad ovate, obtuse, c. 0.25 mm long, thickened and obtuse at base; tails absent; collar narrow-oblong, slightly broader at base, 0.3 mm long. Style apex very narrowly triangular, c. 1 mm long, prominently papillose. Achene compressed barrel-shaped, c. 1.4 mm long, myxogenic; carpopodium absent; pericarp crustaceous, brown, minutely colliculate, the colliculi interspersed with larger duplex, rounded, clear papillae; testa free from pericarp, papery, very pale brown, vascular strand slender and extending around apex of seed and half way down other side. Pappus absent.

Specimens examined. NORTHERN TERRITORY: 12 miles south east of Mt Brockman, *N. Byrnes* 2705 (NT); 18 km north-north-east of Jabiru East, *L.A. Craven* 6347 (CANB); 26 km south-south-east of Jabiru East, *M. Lazarides* 9138 (CANB).

Distribution. Only known from the Kakadu National Park in the Northern Territory.

Habitat. Open *Eucalyptus* or *Acacia* woodland on sandstone plateau.

Etymology. The species is named after the National Park in which it is found.

This species does not appear to be closely related to any other species in the genus. The only other member that has acuminate style branches is *A. acoma* which differs markedly in having broad flat leaves, a naked convex receptacle, and finely tailed anthers.

Thiseltonia

Thiseltonia gracillima (F. Muell. & Tate) Paul G. Wilson, comb. nov.

Humea gracillima F. Muell. & Tate, Trans. & Proc. Roy. Soc. South Australia 16:367(1896); F. Muell., Victorian Nat. 9:144(1893) *nomen*. - *Calomeria gracillima* (F. Muell. & Tate) Heine,

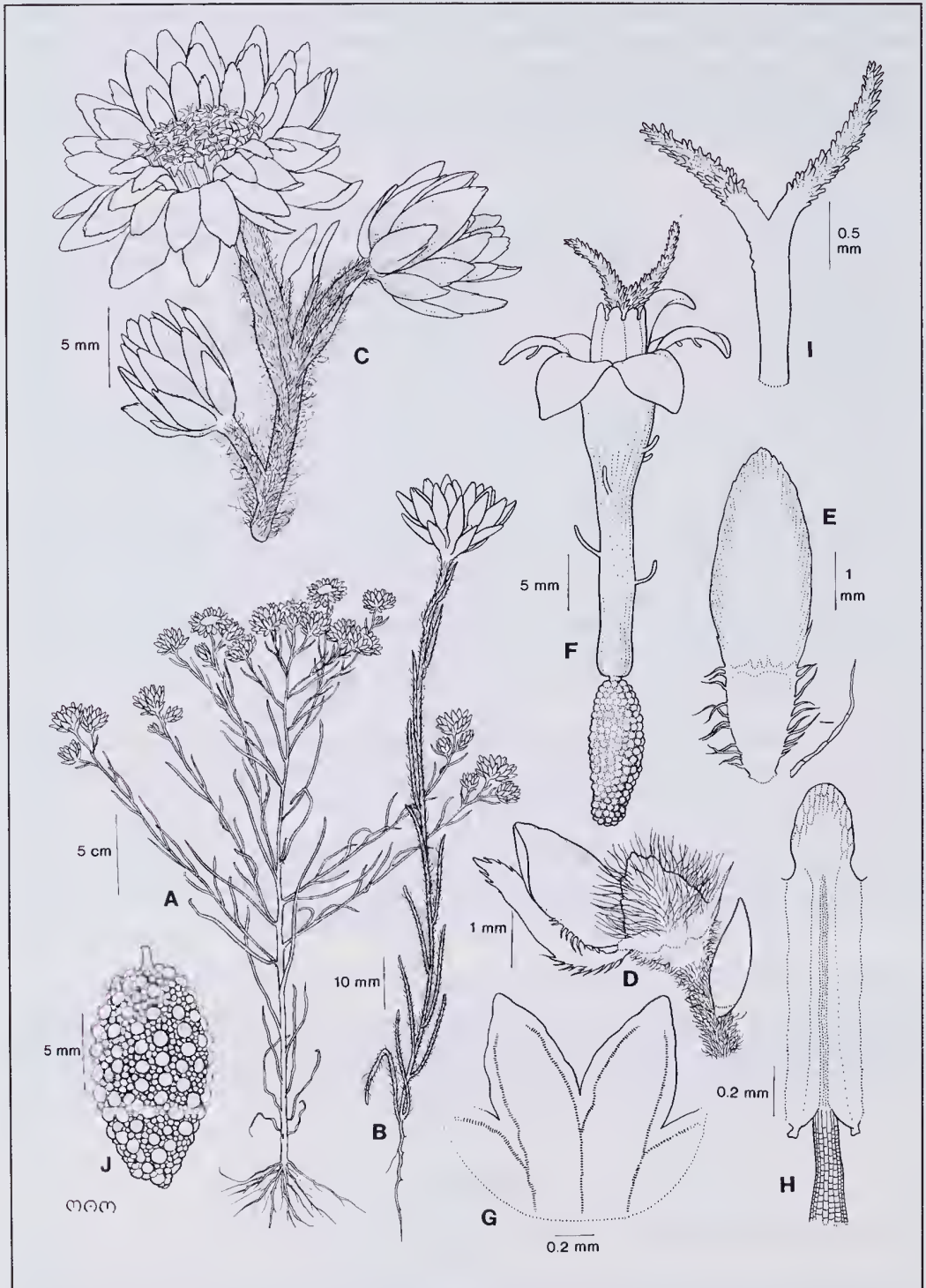


Figure 1. *Acomis kakadu*. A & B - habit. C - cluster of capitula. D - receptacle. E - intermediate involucre bract. F - floret. G - two corolla lobes showing nervation. H - anther. I - style arms. J - achene. A-I from L. Craven 5466, J from L. Craven 6347.

Adansonia ser. 2, 7:138(1967). *Lectotype* (here chosen): Elder Exploring Expedition, Victoria Desert Camp 44 [c. 27°S, 127°E, Western Australia], 7 September 1891, *R. Helms* (MEL, iso: NSW 179949).

Thiseltonia dyeri Hemsley, Hooker's Icon. Pl. 28: tab. 2781(1905). *Typification*: 'West Australia: Dedari, twenty-four miles west of Coolgardie, at 1,400 feet above sea-level, G.H. Thiselton-Dyer'. *Type n.v.*

Hemsley, *op.cit.*, suggested that *Thiseltonia* was related to *Pithocarpa*, while recently Anderberg (1990) has proposed a close affinity to *Hyalosperma* Steetz to which in general appearance *Thiseltonia* undoubtedly corresponds. However, as is mentioned above, the corolla, anthers, style appendages, and involucre bracts of *Thiseltonia* all indicate a close relationship to *Acomis*, an affinity that Mueller (1893) had previously indicated when he placed the taxon in *Humea* sect. *Acomis*.

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CORRECTION

Correction to 'Taxonomic review of the *Grevillea drummondii* Meissn. species group (Proteaceae)' by G.J. Keighery, Nuytsia 8(2): 225-230 (1992)

In the above paper a new species *Grevillea fuscolutea* Keighery, sp. nov. was described. In the heading on page 228 the spelling '*fuscolotea*' was printed, but this was a typographical error and should have read '*fuscolutea*'. The latter spelling was used elsewhere in the paper. Article 73.1 of the 'International Code of Botanical Nomenclature' allows for correction of typographic errors. The spelling *Grevillea fuscolutea* is correct and the spelling '*fuscolotea*' rejected. - Editor.

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Notes for Authors

Nuytsia publishes papers relating to the flora of Western Australia. All papers are refereed outside the Western Australian Herbarium. The Herbarium reserves the right to reject papers.

Manuscripts must be submitted in duplicate, typewritten and double spaced. Printing is now done using a desktop publishing system. After final acceptance of papers authors are requested to provide floppy discs readable directly by IBM computer. Wherever possible, the MS-WORD software should be used in conjunction with a customized style sheet, available from the editor with comprehensive instructions for its use. Alternatives should be discussed with the editor before preparing manuscripts.

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Original figures should not be lettered but instead accompanied by copies indicating lettering. Galley proofs will be forwarded to authors for checking. Twenty reprints of each paper will be provided free of charge; no additional copies may be ordered.

Style and layout should follow recent numbers of *Nuytsia*. Note particularly the following.

Title. Should include the family name of genera or species treated. New taxa should be named if not numerous. The geographic area of study should be given.

Abstract. The paragraph (or paragraphs) should be indented and commence with bibliographic information. New taxa, combinations and names should be listed. The major contents of the paper should be summarised but no additional material given. Key words indicating all ideas and topics covered by the paper must be included to facilitate computerised abstract searching.

Headings. All headings should be in capitals and lower case, major headings being centred and minor ones left justified.

Keys. May be either indented (e.g. *Nuytsia* 5: 277) or bracketed (e.g. *Nuytsia* 5: 84). Indented keys involving more than nine levels of indentation should be avoided. Note that use of the MS-WORD style sheet (see above) considerably facilitates the layout of both indented and bracketed keys.

Species treatments. Use of certain named paragraphs, or sets of paragraphs, for matter following the descriptions is encouraged. The desired sequence and examples of commonly used headings are shown below. Recommended headings which are italicised below, should be left justified, followed by text on the same line.

- (1) Taxon name, synonymy (if any) and type details (for previously published taxa).
- (2) Latin (for new taxa - indented).
- (3) *Typus*: (for new taxa - not indented).
- (4) English description (indented).
- (5) *Other specimens examined* or *Selected specimens examined* as appropriate, preferably including number of collections examined.
- (6) *Distribution*.
- (7) *Habitat*
- (8) *Flowering period*.
- (9) *Fruiting period*.
- (10) *Typification* (discussion).
- (11) *Affinities or Relationships*.
- (12) *Discussion or Comments or Notes*.
- (13) *Conservation status*.
- (14) *Etymology*.

Threatened species. It is the policy of the Western Australian Department of Conservation and Land Management not to publish precise locality data for threatened species. Authors are therefore requested not to cite precise locality data when describing threatened species. Generalised localities should be given accompanied by the statement "precise locality withheld".

Synonymy. The desired format is that used by P.G. Wilson, *Nuytsia* 4: 135-262.

Standard abbreviations. It is suggested that where possible the following standards be followed.

- (1) Author abbreviations — Anon. (1980). Draft index of Author Abbreviations Compiled at the Herbarium, Royal Botanic Gardens, Kew. (HMSO: London.)
- (2) Book titles in literature citations — Stafleu, F.A. & Cowan, R.S. (1976-83). *Taxonomic Literature*. Edn 2. (I.A.P.T.: Utrecht) (but with Capital initial letters.) — Green, J.W. (1985). *Census of the Vascular Plants of Western Australia*. Edn 2. Pp. 20-24. (Department of Agriculture: Perth.)
- (3) Journal titles in literature citations and reference lists — Lawrence, G.H.M. *et al.* (1968). B-P-H (Botanico-Periodicum-Huntianum). — *Green loc. cit.*

Figures. Numbers should follow a single sequence including maps.

Structure of papers. Authors are encouraged to use the conventional structure of scientific papers when a complete study is being reported (e.g. a revision). A *Methods* section should include the method of drawing up the descriptions from specimens, extent of search for types, and discussion of concepts for choice of taxonomic categories. A *discussion* section should be considered, which would include some or all of the following: a summary of the findings, emphasising the most significant; interpretation of the results in the light of other relevant work; statement of new problems which have arisen; advising of aspects which are to be followed up; suggestion of topics which others might usefully pursue; prediction and speculation.



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